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**JP Publication number 2001-166519**

**ELECTROPHOTOGRAPHIC PHOTORECEPTOR, PROCESS CARTRIDGE AND ELECTROPHOTOGRAPHIC DEVICE**

**(57)Abstract:**

**PROBLEM TO BE SOLVED:** To provide an electrophotographic photoreceptor which is good in sensitivity in spite of formation of a protective layer, is little in an increase of residual potential and small in potential fluctuation by environment at change and makes it possible obtain stable electrophotographic characteristics, a process cartridge having the electrophotographic photoreceptor and an electrophotographic device.

**SOLUTION:** The electrophotographic photoreceptor which has a conductive substrate, a photosensitive layer and a protective layer, has the protective layer containing a compound polymerized with a hole transferable component having  $\geq 2$  chain polymerizable functional groups within the same molecule and has the photosensitive layer containing a charge transfer material of  $\geq 350$  in molecular weight, the process cartridge having the electrophotographic photoreceptor and the electrophotographic device.

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**CLAIMS**

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**[Claim(s)]**

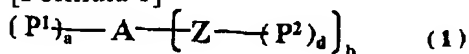
**[Claim 1]** The electrophotography photo conductor characterized by containing the compound which carried out the polymerization of the electron hole transportability compound with which this protective layer has two or more chain pile affinity functional groups in the same molecule in the electrophotography photo conductor which has a conductive base material, a photosensitive layer, and a protective layer, and this photosensitive layer containing with a molecular weight of 350 or more charge transportation material.

**[Claim 2]** The electrophotography photo conductor according to claim 1 with which the aforementioned photosensitive layer contains with an or more 350 molecular weight [ or less 700 ] charge transportation material.

**[Claim 3]** The electrophotography photo conductor according to claim 1 or 2 which is more than 50 mass % to all the charge transportation material of the aforementioned charge transportation material that the aforementioned photosensitive layer contains comparatively.

**[Claim 4]** The electrophotography photo conductor according to claim 1 to 3 whose electron hole transportability compound which has the aforementioned chain pile affinity functional group is the following general formula (1).

**[Formula 1]**



(A shows an electron hole transportability machine among a formula.) P1 and P2 show a chain pile affinity functional group. Even if P1 and P2 are the same, they may differ. Z shows the organic machine which may have a substituent. a, b, and d show zero or more integers, and a+bx+d shows two or more integers. Moreover, when a is two or more, it may differ, even if P1 is the same, and it is d. When it is two or more, even if Z and P2 are the same, they may differ.

**[Claim 5]** The alkylene machine with which Z of the above-mentioned general formula (1) may have a substituent, the arylene machine which may have a substituent, CR1=CR2 (the alkyl





group in which R1 and R2 may have a substituent --) the aryl group or hydrogen atom which may have a substituent is shown, and even if R1 and R2 are the same, you may differ -- an electrophotography photo conductor given in either of the claims 4 which show one or the organic machine put together arbitrarily from C=O, S=O, SO<sub>2</sub>, an oxygen atom, or a sulfur atom [Claim 6] The electrophotography photo conductor according to claim 4 in which Z of the above-mentioned general formula (1) is shown by the following general formula (2).  
[Formula 2]

(X1-X3 show among a formula the alkylene machine which may have a substituent, m(CR<sub>3</sub>=CR<sub>4</sub>) 1, C=O, S=O, SO<sub>2</sub>, an oxygen atom, or a sulfur atom, and Ar1-Ar2 show the arylene machine which may have a substituent.) R3 and R4 show the aryl group or hydrogen atom which may have the alkyl group which may have a substituent, and a substituent, and even if R3 and R4 are the same, they may differ. m1 shows the integer of 1-5, and p-t shows the integer of 0-10. However, p-t is not 0 simultaneously.  
[Claim 7] The electrophotography photo conductor according to claim 4 in which Z of the above-mentioned general formula (1) is shown by the following general formula (3).  
[Formula 3]

(Ar3 shows among a formula the arylene machine which may have a substituent.) X4 and X5 show m (CH<sub>2</sub>)<sub>2</sub>, m (CH=CR<sub>5</sub>)<sub>3</sub>, C=O, or an oxygen atom. R5 shows the aryl group or hydrogen atom which may have the alkyl group which may have a substituent, and a substituent, in m<sub>2</sub>, the integer of 1-10 and m<sub>3</sub> show the integer of 1-5, and u-w shows the integer of 0-10. However, u-w is not 0 simultaneously.  
[Claim 8] The electrophotography photo conductor according to claim 1 to 7 whose oxidation potentials of the compound of an electron hole transportability compound which have two or more chain pile affinity functional groups in the same molecule are 0.4-1.2 (V).  
[Claim 9] The electrophotography photo conductor according to claim 4 to 8 in which the electron hole transportability compound which transposed the bonding site of A, and P1 and Z to the hydrogen atom by the above-mentioned general formula (1) is shown by the following general formula (4).  
[Formula 4]

(R6, R7, and R8 show among a formula the aryl group which may have the aralkyl machine or substituent which may have the alkyl group which may have a substituent, and a substituent.) However, two show an aryl group before long at least. Moreover, even if R6, R7, and R8 are the same respectively, they may differ.  
[Claim 10] The electrophotography photo conductor according to claim 9 which is the aryl group in which R6, R7, and R8 of the above-mentioned general formula (4) may have a substituent.  
[Claim 11] The electrophotography photo conductor according to claim 4 to 8 in which the



electron hole transportability compound which transposed the bonding site of A, and P1 and Z to the hydrogen atom by the above-mentioned general formula (1) is shown by the following general formula (5).

[Formula 5]

(R9-R12 show among a formula the aryl group which may have the aralkyl machine or substituent which may have the alkyl group which may have a substituent, and a substituent.) Moreover, even if R9-R12 are the same respectively, they may differ. Ar4 and Ar5 show the arylene machine which may have a substituent, and even if respectively the same, they may differ. m4 shows 0 or 1.

[Claim 12] The electrophotography photo conductor according to claim 11 which m4 of the above-mentioned general formula (5) is 1, and is the aryl group in which R9-R12 may have a substituent.

[Claim 13] The electrophotography photo conductor according to claim 4 to 12 which is the unsaturation polymerization nature functional group both chain pile affinity both [ one side or ] P1 and P2 are indicated to be by the following general formula (6).

[Formula 6]

the aryl group which may have the alkyl group in which E may have a hydrogen atom, a halogen atom, and a substituent among a formula, and a substituent -- A cyano group, a nitro group, an alkoxy group, and -COOR13 {R13 A hydrogen atom, The aryl group which may have the aralkyl machine or substituent which may have a halogen atom, the alkyl group which may have a substituent, and a substituent or -CONR14R15 {R14, and R15 A hydrogen atom, The aryl group which may have the aralkyl machine or substituent which may have a halogen atom, the alkyl group which may have a substituent, and a substituent is shown. even if mutually the same -- differing -- \*\*\*\* -- the arylene machine with which it may be shown and W may have a substituent -- The alkylene machine and -COO- which may have a substituent, -CH2-, -O-, -OO-, -S-, or -CONR16- {R16 show aryl group} which may have the aralkyl machine or substituent which may have a hydrogen atom, a halogen atom, the alkyl group that may have a substituent, and a substituent. f shows 0 or 1.

[Claim 14] The electrophotography photo conductor according to claim 4 to 12 both chain pile affinity both [ one side or ] P1 and P2 are [ photo conductor ] in any of the following general formula (7) - a general formula (13).

[Formula 7]

[Claim 15] The electrophotography photo conductor according to claim 14 both whose chain pile affinity both [ one side or ] P1 and P2 are the above-mentioned general formula (7) or a general



formula (8).

[Claim 16] The electrophotography photo conductor according to claim 1 to 15 with which a polymerization is performed by the electron ray.

[Claim 17] The electrophotography photo conductor according to claim 16 whose acceleration voltage of an electron ray is 250kV or less.

[Claim 18] The electrophotography photo conductor according to claim 16 or 17 whose dosage of an electron ray is 1 - 100Mrad.

[Claim 19] The process cartridge characterized by the ability to be able to support to one with at least one means chosen from the group which consists of a development means develop with a toner the electrophotography photo conductor with which an electrification means to electrify this electrophotography photo conductor, and the electrostatic latent image were formed in the electrophotography photo conductor according to claim 1 to 18, and a cleaning means collect the toners which carry out the remainder on the electrophotography photo conductor after an imprint process, and able to detach and attach freely on the main part of electrophotography equipment.

[Claim 20] Electrophotography equipment characterized by having an electrification means to electrify an electrophotography photo conductor according to claim 1 to 18 and this electrophotography photo conductor, an exposure means to be exposed to the electrified electrophotography photo conductor and to form an electrostatic latent image, a development means to develop negatives with a toner to the electrophotography photo conductor with which the electrostatic latent image was formed, and an imprint means to imprint the toner image on an electrophotography photo conductor on imprint material.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the electrophotography photo conductor which contains a specific compound in a surface layer, and contains with a molecular weight of 350 or more charge transportation material in a photosensitive layer in detail, the process cartridge which has the electrophotography photo conductor, and electrophotography equipment about an electrophotography photo conductor, a process cartridge, and electrophotography equipment.

[0002]

[Description of the Prior Art] Conventionally, inorganic photoconductivity material, such as a selenium, a cadmium sulfide, and a zinc oxide, was widely used for the electrophotography photo conductor. On the other hand, as an electrophotography photo conductor using an organic photoconductivity material, they are the photoconductivity polymer represented by Polly N-vinyl caliber ZORU and 2 and 5-screw (p-diethylaminophenyl). - 1, 3, the thing using a low-molecular organic photoconductivity material like 4-OKISA diazole, the thing that combined this organic photoconductivity material, various colors, and pigment are known further.

[0003] Since the electrophotography photo conductor using an organic photoconductivity material is good and membrane formation nature can produce it by coating, it has the advantage which productivity can provide with a cheap high electrophotography photo conductor



extremely. Moreover, it had the advantage with a sensitization wavelength region controllable free by selection of a color, a pigment, etc. to be used, and a broad examination has so far been made. The improvement remarkable in the sensitivity and endurance which carried out the laminating of the charge generating layer which especially contained the organic photoconductivity color and the pigment recently, and the charge transporting bed containing photoconductivity polymer or a low-molecular organic photoconductivity material and which were made the fault of the conventional organic electrophotography photo conductor by development of the electrophotography photo conductor of a functional discrete type is made, and this is becoming in use [ an organic electrophotography photo conductor ].

[0004] On the other hand, it is required the sensitivity according to the electrophotography process applied to an electrophotography photo conductor with a natural thing, the electrical property, and that it should have the optical property further. If it is in the electrophotography photo conductor by which repeat use is carried out especially, electric and since mechanical force external is applied directly, endurance over them, such as an imprint to electrification, picture exposure, a toner development, and paper and cleaning processing, is required of the electrophotography photo conductor front face. Specifically, surface degradation by the endurance and electrification over the surface wear and generating of a blemish by \*\*\*\* is mentioned, and the fall of imprint efficiency or slipping nature and the endurance over degradation of electrical properties, such as a sensitivity fall and a potential fall, are also required further in more detail.

[0005] Generally, the front face of an electrophotography photo conductor is a thin resin layer, and the property of a resin is very important for it. Although it considers as the resin with which it is satisfied of above-mentioned terms and conditions to some extent and acrylic resin, polycarbonate resin, etc. are put in practical use in recent years, when it is not satisfied [ with these resins ] of all the properties that were mentioned above and it attains high durability-ization of an electrophotography photo conductor especially, it is hard to say that the coat degree of hardness of this resin is sufficiently high. Even when these resins were used as a resin for surface-layer formation, wear of a surface layer took place repeatedly at the time of use, and there was a trouble that a blemish occurred further.

[0006] Furthermore, although low molecular weight compounds, such as charge transportation material, are added in many cases comparatively in large quantities from the demand to high-sensitivity-izing of an organic electrophotography photo conductor in recent years, film intensity falls remarkably by the operation like a plasticizer of these low-molecular-weight material in this case, and wear and blemish generating of the surface layer at the time of repeat use pose a problem further. Moreover, when saving an electrophotography photo conductor over a long period of time, the above-mentioned low molecular weight constituent deposited, and the problem of carrying out layer separation is also generated.

[0007] As a means to solve these troubles, the attempt which uses the resin of hardenability as a resin for charge transporting beds is indicated by JP,2-127652,A etc. Thus, \*\*\*\*\*-proof and \*\*\*\*-proof at the time of the increase of a mechanical strength and repeat use improve greatly by using the resin of hardenability for the resin for charge transporting beds, hardening a charge transporting bed and constructing a bridge. However, even if it uses a hardenability resin, since a low molecular weight constituent acts as a plasticizer into a binding resin to the last, the problem of a deposit which was described previously, or layer separation is not fundamental solution.

[0008] Moreover, in the charge transporting bed which consists of an organic charge transportation material and a binding resin, by the time it satisfies both -- charge transportation





ability is not enough and elevation of a rest potential is seen at the time of repeat use -- to a hardenability resin with a degree of hardness high enough greatly [ the dependence over the resin of charge transportation ability ], it will not have resulted.

[0009] Moreover, it sets to JP,5-216249,A, JP,7-72640,A, etc. Although the electrophotography photo conductor which the charge transfer layer was made to contain the monomer which has a carbon-carbon double bond, was made to react by the carbon-carbon double bond, heat, or luminous energy of charge transfer material, and formed the charge transfer layer hardening film is indicated Since charge transportation material is only fixed by the polymer main skeleton in the shape of a pendant and cannot fully eliminate a previous plastic operation, a mechanical strength is not enough. Moreover, if concentration of charge transportation material is made high for improvement in charge transportation ability, crosslinking density cannot become low and cannot secure sufficient mechanical strength. Furthermore, we are anxious also about the influence on the electrophotography property of initiators needed at the time of a polymerization.

[0010] Moreover, although the electrophotography photo conductor which the basis which has charge transportation ability was introduced [ photo conductor ] and made the charge transporting bed form into a thermoplastic macromolecule principal chain in JP,8-248649,A etc. as another solution means is indicated although it is effective to a deposit or layer separation as compared with a conventional molecular-dispersion type charge transporting bed and a mechanical strength also improves, it is thermoplastics to the last, and there is a limitation in the mechanical strength and it is hard to say that it enough-comes out in respect of the handling including the solubility of a resin etc., or productivity

[0011] Making into the background what was described above, this invention persons repeated the examination for attaining coexistence of a high mechanical strength and charge transportation ability. Consequently, it was checked that coexistence of a mechanical strength and charge transportation ability is mostly attained with the electrophotography photo conductor containing the compound to which the polymerization of the electron hole transportability compound which has two or more chain pile affinity functional groups in the same molecule was carried out.

[0012] However, although the mechanical strength improved by using the electron hole transportability compound which has two or more chain pile affinity functional groups in the same molecule when this was used as a protective layer, when a photosensitive layer was an organic system photosensitive layer, sensitivity might not fully be obtained and the rise of a rest potential might be seen. Moreover, potential was changed with an environmental change and the stable potential property could not be acquired.

[0013] In order to offer the more excellent electrophotography photo conductor with high-definition-izing in recent years and a raise in durability, these problems surely needed to be solved.

[0014]

[Problem(s) to be Solved by the Invention] Even if the purpose of this invention forms a protective layer, its sensitivity is good, it has few rises of a rest potential, and its potential change by the environmental variation is small, and it is to offer the electrophotography photo conductor with which the stable electrophotography property is acquired.

[0015] Another purpose of this invention is to offer the process cartridge and electrophotography equipment which have the above-mentioned electrophotography photo conductor.

[0016]

[Means for Solving the Problem] The electrophotography photo conductor characterized by containing the compound which carried out the polymerization of the electron hole



transportability compound with which this protective layer has two or more chain pile affinity functional groups in the same molecule in the electrophotography photo conductor which has a conductive base material, a photosensitive layer, and a protective layer according to this invention, and this photosensitive layer containing with a molecular weight of 350 or more charge transportation material is offered.

[0017] Moreover, according to this invention, the process cartridge and electrophotography equipment which have the above-mentioned electrophotography photo conductor are offered.  
[0018]

[Embodiments of the Invention] Next, the composition of the electrophotography photo conductor of this invention is explained in detail.

[0019] First, the protective layer in this invention is explained. First, the electron hole transportability compound which has a chain pile affinity functional group is explained.

[0020] The chain polymerization in this invention shows the polymerization-reaction form of the former at the time of roughly dividing the generation reaction of a high polymer into chain polymerization and successive polymerization. It is Gihodo Shuppan Co., Ltd. in detail. As explained to "chemistry [ of basic synthetic resin ] (new edition)" 1995 year 7 month 25 day (1st edition 8 \*\*) P.24 of three-bird Tadahiro work The form says things, such as an unsaturation polymerization to which a reaction mainly advances via intermediate fields, such as a radical or ion, ring opening polymerization, and isomerization polymerization. In the chain pile affinity functional groups P1 and P2 in the aforementioned general formula (1), although the functional group in which the above-mentioned reaction form is possible is meant, the most is occupied here and the example of the large unsaturation polymerization of the application range or a ring-opening-polymerization nature functional group is shown.

[0021] Although an unsaturation polymerization is a reaction in which an unsaturation machine, for example,  $C=C$ ,  $C^*C$ ,  $C=O$ ,  $C=N$ ,  $C^*N$ , etc. carry out a polymerization by the radical, ion, etc., it is mainly  $C=C$ . Although the example of an unsaturation polymerization nature functional group is shown in Table 1, it is not limited to these.

[0022]

[Table 1]

[0023] Front Naka and R show an aryl group or hydrogen atoms, such as a phenyl group which may have aralkyl machines, such as a benzyl which may have alkyl groups, such as a methyl group which may have a substituent, an ethyl group, a propyl group, and a butyl, and a substituent, a phenethyl machine, a naphthyl methyl group, a furfuryl machine, and a thienyl group, and a substituent, a naphthyl group, and an anthryl machine.

[0024] Although ring opening polymerization is a reaction which repeats a polymerization and generates a chain macromolecule object at the same time it is activated and an unstable cyclic structure with the strain of a ring, an OKUSO ring, a nitrogen heterocycle, etc. carries out ring breakage in an operation of a catalyst, that on which ion acts as active species fundamentally in this case is most. Although the example of a ring-opening-polymerization nature functional group is shown in Table 2, it is not limited to these.

[0025]

[Table 2]



[0026] Front Naka and R show an aryl group or hydrogen atoms, such as a phenyl group which may have aralkyl machines, such as a benzyl which may have alkyl groups, such as a methyl group which may have a substituent, an ethyl group, a propyl group, and a butyl, and a substituent, a phenethyl machine, a naphthyl methyl group, a furfuryl machine, and a thienyl group, and a substituent, a naphthyl group, and an anthryl machine.

[0027] Also in the chain pile affinity functional group concerning this invention which was explained above, what is shown by the following general formula (6), (14), and (15) is desirable.

[0028]

[Formula 8]

[0029] The methyl group in which E may have halogen atoms, such as a hydrogen atom, a fluorine, chlorine, and a bromine, and a substituent among a formula, The benzyl which may have alkyl groups, such as an ethyl group, a propyl group, and a butyl, and a substituent, Aralkyl machines, such as a phenethyl machine, a naphthyl methyl group, a furfuryl machine, and a thienyl group, Alkoxy groups, such as aryl groups, such as the phenyl group and naphthyl group which may have a substituent, an anthryl machine, a pyrenyl machine, a thiophenyl machine, and a furil machine, a methoxy machine, an ethoxy basis, and a propoxy group, CN basis, a nitro group, -COOR<sup>13</sup>, or -CONR<sup>14</sup>R<sup>15</sup> is shown.

[0030] W is shown by alkylene machines, such as arylene machines, such as a phenylene group which may have a substituent, a naphthylene machine, and an anthracenylene group, a methylene group which may have a substituent, an ethylene, and a butylene, -COO-, -CH<sub>2</sub>-, -O-, -OO-, -S-, or -CONR<sup>16</sup>-.

[0031] R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, and R<sup>16</sup> show aryl groups, such as the phenyl group and naphthyl group which may have an aralkyl machine or substituents, such as a benzyl which may have alkyl groups, such as a methyl group which may have halogen atoms, such as a hydrogen atom, a fluorine, chlorine, a bromine, and iodine, and a substituent, an ethyl group, a propyl group, and a butyl, and a substituent, and a phenethyl machine, and an anthryl machine, and even if R<sup>14</sup> and R<sup>15</sup> are mutually the same, Moreover, f shows 0 or 1.

[0032] As a substituent which you may have in E and W, halogen atom; nitro groups, such as a fluorine, chlorine, a bromine, and iodine, Alkyl groups, such as a cyano group, a hydroxyl-group; methyl group, an ethyl group, a propyl group, and a butyl; A methoxy machine, alkoxy-groups [, such as an ethoxy basis and a propoxy group, ]; -- aryloxy group [, such as a phenoxy machine and a naphthoxy machine, ]; -- a benzyl -- Aryl groups, such as aralkyl machine [, such as a phenethyl machine, a naphthyl methyl group, a furfuryl machine and a thienyl group, ]; or a phenyl group, a naphthyl group, an anthryl machine, and a pyrenyl machine, etc. are mentioned.

[0033]

[Formula 9]

[0034] R<sup>17</sup> and R<sup>18</sup> show among a formula aryl groups, such as a phenyl group, a naphthyl group, etc. which may have aralkyl machines, such as a benzyl which may have alkyl groups, such as a methyl group which may have a hydrogen atom and a substituent, an ethyl group, a propyl group, and a butyl, and a substituent, and a phenethyl machine, or a substituent, and n shows the integer of 1-10.



[0035]  
[Formula 10]

R19 and R20 show among a formula aryl groups, such as a phenyl group, a naphthyl group, etc. which may have aralkyl machines, such as a benzyl which may have alkyl groups, such as a methyl group which may have a hydrogen atom and a substituent, an ethyl group, a propyl, and a butyl, and a substituent, and a phenethyl machine, or a substituent, and n shows the integer of 0-10.

[0036] As a substituent which R17, R18, R19, and R20 of (14) of the above-mentioned general formula and (15) may have, in addition, a fluorine, Alkyl groups, such as halogen atom; methyl groups, such as chlorine, a bromine, and iodine, an ethyl group, a propyl group, and a butyl; A methoxy machine, alkoxy-groups [, such as an ethoxy basis and a propoxy group, ]; -- aryloxy group [, such as a phenoxy machine and a naphthoxy machine, ]; -- a benzyl -- Aryl groups, such as aralkyl machine [, such as a phenethyl machine, a naphthyl methyl group, a furfuryl machine and a thienyl group, ]; or a phenyl group, a naphthyl group, an anthryl machine, and a pyrenyl machine, etc. are mentioned.

[0037] Moreover, as a still more desirable chain pile affinity functional group, what is shown by the following general formula (7) - the general formula (13) is mentioned also in the above-mentioned general formula (6), (14), and (15).

[0038]  
[Formula 11]

[0039] Furthermore, the acryloyloxy machine of a general formula (7) and the methacryloyloxy machine of a general formula (8) are especially the most desirable from points, such as a polymerization property, also in the above-mentioned general formula (7) - a general formula (13).

[0040] Next, the electron hole transportability material in this invention is explained.

[0041] "The electron hole transportability compound which has a chain pile affinity functional group" shows two or more compounds which are carrying out the chemical bond to the electron hole transportability compound which the chain pile affinity functional group explained above explains below preferably as a functional group by this invention. In this case, even if all of those chain pile affinity functional groups are the same, they may differ.

[0042] As an electron hole transportability compound which has those two or more chain pile affinity functional groups, the case where it is the following general formula (1) is desirable.

[0043]  
[Formula 12]

[0044] A shows an electron hole transportability machine among a formula. P1 and P2 show a chain pile affinity functional group. Even if P1 and P2 are the same, they may differ. Z shows the organic machine which may have a substituent. a, b, and d show zero or more integers, and a+bx+d shows two or more integers. Moreover, when a is two or more, it may differ, even if P1 is





the same, and it is d. When it is two or more, even if Z and P2 are the same, they may differ. [0045] You may differ, even if P1 is the same here, when "a is two or more. in addition, with " They are n kinds of chain pile affinity functional groups different, respectively P11, P12, P13, P14, and P15 .... When it is indicated as P1n, for example, all three polymerization nature functional groups P1 coupled directly with the electron hole transportability compound A at the time of a= 3 the same thing That (for example, P11, and P11 and P12) from which two are the same as and one is different it means that a thing (for example, P12, and P15 and P17) different three, respectively may be used (when "d is two or more, even when P2 is the same -- you may differ -- " -- that is,) It means that it is the same as that of "they differing even if Z and P2 are the same when b is two or more", that is, this.

[0046] The electron hole transportation compound which transposed the bonding site with A, P1, and Z of the above-mentioned general formula (1) to the hydrogen atom For example, an oxazole derivative, an OKISA diazole derivative, an imidazole derivative, Triaryl amine derivatives, such as a triphenylamine, 9-(p-diethylaminostyryl) anthracene, A 1 and 1-screw-(4-dibenzyl aminophenyl) propane, a styryl anthracene, A styryl pyrazoline, phenylhydrazones, a thiazole derivative, a triazole derivative, a phenazine derivative, an acridine derivative, a benzofuran derivative, a bends imidazole derivative, a thiophene derivative, N-phenyl carbazole derivative, etc. are mentioned.

[0047] Furthermore, what is the condensation heterocycle which has the basis shown by the compound shown also in the above-mentioned electron hole transportation compound by the formula chosen from the following general formula (4), (5), (16), (17), and (19), the condensed-ring hydrocarbon which has the basis shown by the following general formula (18), or the following general formula (18) is desirable. Furthermore, especially the case where it is the compound shown by the general formula (4) and (5) also in it is desirable.

[0048]

[Formula 13]

[0049] The methyl group in which R6, R7, and R8 may have a substituent among the above-mentioned general formula (4), A ten or less carbon numbers [, such as an ethyl group, a propyl group, and a butyl, ] alkyl group, The benzyl which may have a substituent, a phenethyl machine, a naphthyl methyl group, The phenyl group which may have an aralkyl machine or substituents, such as a furfuryl machine and a thienyl group A naphthyl group, an anthryl machine, a phenan thrill machine, a pyrenyl machine, a thiophenyl machine, Aryl groups, such as a furil machine, a pyridyl machine, a quinolyl machine, a benzo quinolyl machine, a carbazolyl machine, a phenothiazinyl group, a benzo furil machine, a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown.

[0050] However, at least two of R6, R7, and R8 show an aryl group, and even if R6, R7, and R8 are the same respectively, they may differ. Furthermore, especially the thing whose all of R6, R7, and R8 are aryl groups also in it is desirable. Moreover, among R6 of the above-mentioned general formula (4), R7, or R8, arbitrary two may be combined through a direct or joint machine, respectively, and a hetero atom or CH=CH bases, such as alkylene machines, such as a methylene group, an ethylene, and a propylene machine, an oxygen atom, and a sulfur atom, etc. are mentioned as the joint machine.

[0051]

[Formula 14]



[0052] Among the above-mentioned general formula (5),  $m_4$  shows 0 or 1 and its case where it is  $m_4=1$  is desirable. A ten or less carbon numbers [ , such as a methyl group in which R9-R12 may have a substituent, an ethyl group, a propyl group, and a butyl, ] alkyl group, The benzyl which may have a substituent, a phenethyl machine, a naphthyl methyl group, The phenyl group which may have an aralkyl machine or substituents, such as a furfuryl machine and a thienyl group A naphthyl group, an anthryl machine, a phenanthryl machine, a pyrenyl machine, a thiophenyl machine, Aryl groups, such as a furil machine, a pyridyl machine, a quinolyl machine, a benzo quinolyl machine, a carbazolyl machine, a phenothiazinyl group, a benzo furil machine, a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown, and even if R9-R12 are the same respectively, they may differ.

[0053] the arylene machine (benzene and naphthalene --) with which Ar4 may have a substituent An anthracene, a phenanthrene, a pyrene, a thiophene, a furan, a pyridine, A quinoline, a benzo quinoline, a carbazole, a phenothiazin, a benzofuran, The basis which removed two hydrogen atoms from benzothiophene, the dibenzofuran, the dibenzo thiophene, etc. is shown. In the case of  $m_4=0$ , Ar5 A phenyl group, a naphthyl group, an anthryl machine, A phenanthryl machine, a pyrenyl machine, a thiophenyl machine, a furil machine, a pyridyl machine, Aryl groups, such as a quinolyl machine, a benzo quinolyl machine, a carbazolyl machine, a phenothiazinyl group, a benzo furil machine, a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown, and, in the case of  $m_4=1$ , the same arylene machine as the above Ar1 is shown. In addition, in the case of  $m_4=1$ , even if Ar4 and Ar5 are the same, you may differ.

[0054] Furthermore, also in it, especially the case where all four R9-R12 in the above-mentioned general formula (5) are all an aryl group is desirable. Moreover, although R9 and R10 of the above-mentioned general formula (5), R11 and R12, or Ar4 and Ar5 may be combined through a direct or joint machine, respectively and a hetero atom or CH=CH bases, such as alkylene machines, such as a methylene group, an ethylene, and a propylene machine, a carbonyl group, an oxygen atom, and a sulfur atom, etc. are mentioned as the joint machine, in these, an alkylene machine is desirable.

[0055]

[Formula 15]

[0056] The methyl group in which R21, R22, R23, and R24 may have a substituent among the above-mentioned general formula (16), A ten or less carbon numbers [ , such as an ethyl group, a propyl group, and a butyl, ] alkyl group, The benzyl which may have a substituent, a phenethyl machine, a naphthyl methyl group, The phenyl group which may have an aralkyl machine or substituents, such as a furfuryl machine and a thienyl group A naphthyl group, an anthryl machine, a phenanthryl machine, a pyrenyl machine, a thiophenyl machine, A furil machine, a pyridyl machine, a quinolyl machine, a benzo quinolyl machine, a carbazolyl machine, Aryl groups, such as a phenothiazinyl group, a benzo furil machine, a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown, and even if R21, R22, R23, and R24 are the same respectively, they may differ. A ten or less carbon numbers [ , such as a methylene group, an ethylene a propylene machine, etc. with which R25 and R26 may have a substituent, ] alkylene machine, or the arylene machine (benzene, naphthalene, and an anthracene



--) which may have a substituent A phenanthrene, a pyrene, a thiophene, a furan, a pyridine, a quinoline, The basis which removed two hydrogen atoms from a benzo quinoline, a carbazole, a phenothiazin, a benzofuran, benzothiophene, the dibenzofuran, the dibenzo thiophene, etc. is shown, and even if R25 and R26 are the same, they may differ. Q shows the organic machine which may have a substituent.

[0057] Furthermore, also in it, it is the aryl group in which at least two of R21, R22, R23, and R24 in the above-mentioned general formula (16) may have a substituent, and the case where it is the arylene machine with which R25 and R26 may have a substituent is desirable, and especially the case where R21, R22, R23, and all four R 24 are all the aryl groups which may have a substituent further is desirable. Moreover, among R21, R22, and R25 of the above-mentioned general formula (16), arbitrary two may be combined through a direct or joint machine, respectively, and a hetero atom or CH=CH bases, such as alkylene machines, such as a methylene group, an ethylene, and a propylene machine, an oxygen atom, and a sulfur atom, etc. are mentioned as the joint machine among arbitrary two, or R23, R24 and R26.

[0058]

[Formula 16]

[0059] However, at least one of R27, R28, and Ar6 has at least one basis shown by the following general formula (18).

[0060]

[Formula 17]

[0061] The phenyl group in which Ar6 and Ar7 may have a substituent among the above-mentioned general formula (17) and (18), A naphthyl group, an anthryl machine, a phenan thrill machine, a pyrenyl machine, a thiophenyl machine, A furil machine, a pyridyl machine, a quinolyl machine, a benzo quinolyl machine, a carbazolyl machine, Aryl groups, such as a phenothiazinyl group, a benzo furil machine, a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown. The methyl group in which R27, R28, R29, and R30 may have a substituent, A ten or less carbon numbers [, such as an ethyl group, a propyl group and a butyl, ] alkyl group, The benzyl which may have a substituent, a phenethyl machine, a naphthyl methyl group, Aralkyl machines, such as a furfuryl machine and a thienyl group, the phenyl group which may have a substituent, A naphthyl group, an anthryl machine, a phenan thrill machine, a pyrenyl machine, a thiophenyl machine, A furil machine, a pyridyl machine, a quinolyl machine, a benzo quinolyl machine, a carbazolyl machine, Aryl groups, such as a phenothiazinyl group, a benzo furil machine, a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown, and, in addition to these alkyl groups, an aralkyl machine, and an aryl group, R29 and R30 show a hydrogen atom. Furthermore, even if R27, R28, and R29 and R30 are the same respectively, they may differ.

[0062] Moreover, among R27, R28, or Ar6, arbitrary two, or Ar7 and R30 may be combined through a direct or joint machine, respectively, and a hetero atom or CH=CH bases, such as alkylene machines, such as a methylene group, an ethylene, and a propylene machine, an oxygen atom, and a sulfur atom, etc. are mentioned as the joint machine. n1 shows the integer of 0-2. In addition, the case where R30 is an aryl group also in it is desirable, and especially the case where R27 and R28 are aryl groups further is desirable.



[0063] Furthermore, as a compound which has the basis shown by the above-mentioned general formula (18), condensation heterocycles, such as the benzofuran machine which may have a condensed-ring hydrocarbon or substituents, such as the naphthalene machine which may have a substituent, an anthracene machine, a phenanthrene machine, a PEREN machine, a fluorene machine, a full ORANSEN machine, an azulene machine, an indene machine, a perylene machine, a chrysene machine, and a coronene machine, the Indore machine, a carbazol group, a bends carbazole machine, an acridine

[0064]

[Formula 18]

[0065] However, the above-mentioned general formula (19) has at least one basis shown by the following general formula (20).

[0066]

[Formula 19]

[0067] The phenyl group in which Ar8, Ar9, and Ar10 may have a substituent among the above-mentioned general formula (19) and (20), A naphthyl group, an anthryl machine, a phenan thrill machine, a pyrenyl machine, a thiophenyl machine, A furil machine, a pyridyl machine, a quinolyl machine, a benzo quinolyl machine, a carbazolyl machine, Aryl groups, such as a phenothiazinyl group, a benzo furil machine, a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown. The methyl group, ethyl group in which R31, R32, and R33 may have a substituent, The benzyl which may have a ten or less carbon numbers [, such as a propyl group and a butyl, ] alkyl group and a substituent, Aralkyl machines, such as a phenethyl machine, a naphthyl methyl group, a furfuryl machine, and a thienyl group, The phenyl group and naphthyl group which may have a substituent, an anthryl machine, a phenan thrill machine, A pyrenyl machine, a thiophenyl machine, a furil machine, a pyridyl machine, a quinolyl machine, A benzo quinolyl machine, a carbazolyl machine, a phenothiazinyl group, a benzo furil machine, Aryl groups, such as a benzo thiophenyl machine, a dibenzo furil machine, and a dibenzo thiophenyl machine, are shown, and, in addition to these alkyl groups, an aralkyl machine, and an aryl group, R32 and R33 show a hydrogen atom. In addition, even if Ar8 and Ar9, and R32 and R33 are the same respectively, they may differ.

[0068] Also in it, the case where R31 and R32 are aryl groups is desirable. Moreover, among R31, Ar8, or Ar9, arbitrary two, or Ar10 and R33 may be combined through a direct or joint machine, respectively, and a hetero atom or CH=CH bases, such as alkylene machines, such as a methylene group, an ethylene, and a propylene machine, an oxygen atom, and a sulfur atom, etc. are mentioned as the joint machine. n2 shows the integer of 0-2.

[0069] Moreover, the alkylene machine with which Z in the above-mentioned general formula (1) and Q in the above-mentioned general formula (16) may have a substituent, One or the organic machine put together arbitrarily is shown from the arylene machine and CR1=CR2 (R1 and R2 show an alkyl group, an aryl group, or a hydrogen atom, and even if R1 and R2 are the same, they may differ) which may have a substituent, C=O, S=O, SO2, an oxygen atom, or a sulfur atom. What is shown by the following general formula (2) also in it is desirable, and especially the thing shown by the following general formula (3) is desirable.

[0070]





[Formula 20]

[0071]

[Formula 21]

[0072] The methylene group in which X1-X3 may have a substituent among the above-mentioned general formula (2), A 20 or less carbon numbers [ , such as an ethylene and a propylene machine, ] alkylene machine, m(CR3=CR4) 1, C=O, the arylene machine (benzene --) with which S=O, SO<sub>2</sub>, an oxygen atom, or a sulfur atom may be shown, and Ar1 and Ar2 may have a substituent Naphthalene, an anthracene, a phenanthrene, a pyrene, a thiophene, The basis which removed two hydrogen atoms from a furan, a pyridine, a quinoline, a benzo quinoline, a carbazole, a phenothiazin, a benzofuran, benzothiophene, the dibenzofuran, the dibenzo thiophene, etc. is shown. R<SUP>3</SUP> and R4 show an aryl group or hydrogen atoms, such as a phenyl group which may have alkyl groups, such as a methyl group which may have a substituent, an ethyl group, a propyl group, and a butyl, and a substituent, a naphthyl group, and a thiophenyl machine, and even if R3 and R4 are the same, they may differ. m1 shows the integer of 1-5, and p-t shows the integer of 0-10 (however, p-t is not 0 simultaneously).

[0073] X4 and X5 show m (CH<sub>2</sub>)<sub>2</sub>, m (CH=CR<sub>5</sub>)<sub>3</sub>, C=O, or an oxygen atom among the above-mentioned general formula (3), and Ar3 shows the arylene machine (basis which removed two hydrogen atoms from benzene, naphthalene, an anthracene, a phenanthrene, a pyrene, a thiophene, a furan, a pyridine, a quinoline, a benzo quinoline, a carbazole, a phenothiazin, a benzofuran, benzothiophene, the dibenzofuran, the dibenzo thiophene, etc.) which may have R5 shows an aryl group or hydrogen atoms, such as a phenyl group which may have alkyl groups, such as a methyl group which may have a substituent, an ethyl group, a propyl group, and a butyl, and a substituent, a naphthyl group, and a thiophenyl machine. In m2, the integer of 1-10 and m3 show the integer of 1-5, and u-w shows the integer of 0-10 (especially the time especially of the integer of 0-5 is desirable.). However, u-w is not 0 simultaneously.

[0074] As a substituent which R1-R5 of above-mentioned general formula (1) - (3), (5), (6), and (14) - (20), R9-R33, Ar1-Ar10, X1-X5, and Z and Q may have, respectively, in addition, a fluorine, Halogen atom; nitro groups, such as chlorine, a bromine, and iodine, a cyano group, a hydroxyl group; A methyl group, Alkoxy groups, such as alkyl group; methoxy machines, such as an ethyl group, a propyl group, and a butyl, an ethoxy basis, and a propoxy group; A phenoxy machine, aryloxy group [ , such as a naphthoxy machine, ]; -- aralkyl machines, such as a benzyl, a phenethyl machine, a naphthyl methyl group, a furfuryl machine, and a thienyl group, -- aryl groups, such as; phenyl group, a naphthyl group, an anthryl machine, and a pyrenyl machine, are mentioned Moreover, as a substituent which R6-R8 of a general formula (4) may have, diaryl amino groups, such as the above-mentioned substituent except the aryl group, a diphenylamino machine, and a JI (p-tolyl) amino group, are mentioned.

[0075] Moreover, as for the electron hole transportability compound which has one or more chain pile affinity functional groups in the same molecule in this invention, it is desirable that an oxidation potential is below 1.2 (V), and it is especially desirable that it is 0.4-1.2 (V). That pouring of the charge (electron hole) from charge generating material cannot take place easily if an oxidation potential 1.2 (V) Exceeds it Elevation of a rest potential, It is easy to produce problems, like sensitivity aggravation and the potential change at the time of repeat use become



large. Moreover, it is to become easy to produce problems, like the sensitivity aggravation which was easy to deteriorate in order for the compound itself [ other than problems such as a fall of electrification ability, ] to oxidize easily, and originated in it, picture dotage, and the potential change at the time of repeat use become large under in 0.4 (V).

[0076] In addition, the oxidation potential described here is measured by the following methods.

[0077] (Measuring method of an oxidation potential) The saturated calomel electrode was made into the reference electrode, the 0.1-N(n-Bu) 4 N+ClO<sub>4</sub>-acetonitrile solution was used for the electrolytic solution, and potential when the sweep of the potential impressed to a working electrode (platinum) by the potential sweeper is carried out and the obtained current potential curve shows a peak was made into the oxidation potential. In detail, a sample is dissolved in a 0.1-N(n-Bu) 4 N+ClO<sub>4</sub>-acetonitrile solution so that it may become about [ 5-10mmol% ] concentration. And voltage is applied by the working electrode at this sample solution, the current change when changing voltage from low voltage (0V) to high potential (+1.5V) linearly is measured, and a current potential curve is obtained. In this current potential curve, potential of the position of the peak top when current value shows a peak (it is the first peak when there are two or more peaks) was made into the oxidation potential.

[0078] Furthermore, that in which the electron hole transportability compound which has the above-mentioned chain pile affinity functional group has the drift mobility more than  $1 \times 10^{-7}$  (cm<sup>2</sup>/V.sec) as electron hole transportation ability is desirable (however, impression electric-field:  $5 \times 10^4$  V/cm). Under in  $1 \times 10^{-7}$  (cm<sup>2</sup>/V.sec), since an electron hole cannot fully move by after [ exposure ] development as an electrophotography photo conductor, sensitivity may decrease seemingly, and the problem to which a rest potential also becomes high may occur.

[0079] Although the example of representation of the electron hole transportability compound which has a chain pile affinity functional group concerning this invention is given to below, it is not limited to these.

[0080]

[Formula 22]

[0169] In this invention, it is carrying out the polymerization of the electron hole transportability compound which has two or more chain pile affinity functional groups in the same aforementioned molecule, and the compound which has electron hole transportation ability forms the 3-dimensional structure of cross linkage with two or more points constructing a bridge into a protective layer. any of the aforementioned electron hole transportability compound carrying out the polymerization only of it, or mixing it with the compound which has other chain pile affinity functional groups -- although -- it is possible and the whole of its kind / ratio is arbitration being mentioned here -- others -- either the monomer which has a chain pile affinity functional group with the compound which has a chain pile affinity functional group, or oligomer/polymer -- although -- it is contained

[0170] A basis with same functional group of an electron hole transportability compound and functional group of other chain pile affinity compounds, or when it is the basis in which a polymerization is possible mutually, both can take the 3-dimensional copolymerization structure of cross linkage through covalent bond. Although a protective layer is constituted as what contained other chain pile affinity compound monomer or its hardened material in the mixture of two or more 3-dimensional hardened materials, or the 3-dimensional hardened material of a principal component when both functional group is a functional group which does not carry out a



polymerization mutually, it is controlling well its rate of a compounding ratio / the film production method, and it is also possible to form IPN (Inter Penetrating Network), i.e., the mutual penetration network structure.

[0171] Moreover, you may form a protective layer from the monomer which has the aforementioned electron hole transportability compound and polymerization nature machines other than a chain pile affinity functional group, or oligomer/polymer. Moreover, you may contain a \*\* agent and others, such as other various additives and a fluorine atom content resin particle.

[0172] In this invention, the polymerization of the electron hole transportability compound which has a chain pile affinity functional group can be carried out according to light, such as heat, the light, and ultraviolet rays, and also radiation. Therefore, depending on the electron hole transportability compound and the need of having the aforementioned chain pile affinity functional group, formation of the protective layer in this invention makes the coating liquid for protective layers contain a polymerization initiator, and carries out the polymerization of the electron hole transportability compound which has this chain pile affinity functional group to the coating film formed using this coating liquid by irradiating light or radiation. In addition, in this invention, it is desirable to carry out the polymerization of the electron hole transportability compound which has this chain pile affinity functional group according to radiation also in it. The greatest advantage of the polymerization by radiation is a point which does not need a polymerization initiator, and is a point that become producible [ a thereby very high grade 3-dimensional protective layer ], and good endurance is secured. Moreover, it is a short time, and although it is efficient polymerization reaction therefore, productivity is also high, and it is further mentioned from the penetrable goodness of radiation that the influence of the hardening prevention at the time of shielding material, such as the time of a thick film and an additive, existing in a film is very small etc. However, addition of the polymerization initiator within the limits which polymerization reaction may be unable to advance easily depending on the kind of chain pile affinity functional group or the kind of os-centrale rank, and do not have influence in that case is possible. Under the present circumstances, an electron ray is especially desirable although the radiation to be used is an electron ray and a gamma ray.

[0173] When carrying out electron beam irradiation, as an accelerator, a scanned type, an electro curtain type, a broad-beam type, a pulse type, a lamina type, etc. can use any form. Irradiation conditions are very important, when irradiating an electron ray and making an electrical property discover in the electrophotography photo conductor of this invention. In this invention, 250kV or less of acceleration voltage is desirable, and it is 150kV or less the optimal. moreover, dosage -- desirable -- the range of 1Mrad - 100Mrad -- it is the range of 3Mrad(s) - 50Mrad more preferably When acceleration voltage exceeds 250kV, it is in the inclination which the damage of the electron beam irradiation to a photo conductor property increases. Moreover, since hardening is easy to become inadequate, and degradation of a photo conductor property tends to take place in [ than dosage 100Mrad ] more when there is less quantity of radiation than 1Mrad, cautions are required.

[0174] More than 20 mass % of the hydrogenation object of the electron hole transportability machine A which has the chain pile affinity functional group shown by the aforementioned general formula (1) to the total mass of the protective-layer film after polymerization hardening is desirable, and, as for the amount of the aforementioned electron hole transportability compound, it is desirable to contain more than 40 mass % especially. Charge transportation ability falls that it is under 20 mass %, and it is easy to produce troubles, such as a sensitivity fall



and elevation of a rest potential. The thickness as a protective layer in this case has desirable 0.1-10 micrometers, and its 0.5-7 micrometers are especially desirable.

[0175] Next, a photosensitive layer is explained.

[0176] Although the mechanical strength improved by leaps and bounds by using the electron hole transportability compound which has two or more chain pile affinity functional groups in the same molecule as a protective layer like the above-mentioned, when a photosensitive layer was an organic system photosensitive layer, sensitivity might not fully be obtained, and elevation of a rest potential might be seen. Moreover, potential was changed with an environmental change and the fully stabilized potential property could not be acquired.

[0177] As a result of inquiring wholeheartedly, between the molecular weight of the charge transportation material in the photosensitive layer which touches a protective layer, sensitivity, remaining electricity, and environmental potential change, this invention persons found out that it was related, and resulted at this invention. That is, the fall of sensitivity and elevation of a rest potential could be suppressed by making or more into 350 molecular weight of the charge transportation material of the photosensitive layer which touches a protective layer, and environmental potential change was also able to be suppressed.

[0178] The mechanism of this invention is considered as follows, although it is not certain. Facing the electron hole transportability compound which has two or more chain pile affinity functional groups in the same molecule carrying out a polymerization by irradiating light and radiation as a protective layer, light and radiation have also reached the photosensitive layer under a protective layer. This light and radiation degrade the charge generating material and charge transportation material in a photosensitive layer, and are considered that a photoconductor property falls. Although degradation by cutting of a molecule produces the charge transportation material with small molecular weight, without the ability distributing the light and the energy of radiation which were absorbed, the charge transportation material with large molecular weight can carry out the light and the energy of radiation which were absorbed under non-localization, stabilization becomes possible by changing into heat energy, and it is thought that degradation is suppressed. Moreover, it is thought that degradation of charge generating material is also suppressed because charge transportation material transforms light and the energy of radiation to heat energy. Therefore, when charge transportation material with large molecular weight is used, it is thought that degradation of the charge generating material by light and radiation and charge transportation material can be suppressed.

[0179] In this invention, it is desirable that the molecular weight of charge transportation material is 700 or less [ 350 or more ]. It is because the inclination for a potential property and environmental variation to get worse is seen probably because solubility will fall, if 700 is exceeded.

[0180] As long as the charge transportation material which the photosensitive layer in this invention contains is 350 or more molecular weight, which thing is sufficient as them. For example, triaryl amine derivatives, such as triaryl alkane derivatives, such as heterocyclic compounds, such as a high molecular compound which has heterocycles and condensation polycyclic aromatic series, such as Polly N-vinylcarbazole and the poly styryl anthracene, and a pyrazoline, an imidazole, an oxazole, a triazole, a carbazole, and a triphenylmethane color, and a triphenylamine, a phenylenediamine derivative, N-phenyl carbazole derivative, a stilbene derivative, a hydrazone derivative, a butadiene derivative, etc. are mentioned.

[0181] The example of a compound and molecular weight of charge transportation material are shown below. Since example No.of compound1-No.11 are less than 350 molecular weight, they





are a compound besides this invention. The charge transportation material used for this invention, of course is not restricted to these.

[0182]

[Formula 111]

[0192] In this invention, charge transportation material other than the charge transportation material whose molecular weight is 350 or more can be added further. however, the charge transportation material whose molecular weight is 350 or more in order to fully acquire the effect of this invention is more than 50 mass % of all the charge transportation material in a photosensitive layer -- desirable -- further -- it is more desirable that it is a 70 mass % not less

[0193] The composition of the electrophotography photo conductor of this invention can also take which monolayer [ which consists of a laminating type which carried out the laminating of the charge transporting bed containing the charge generating layer and charge transportation material which contain charge generating material as a photosensitive layer under a protective layer, and a binding resin to this order, and a monolayer which has charge generating material, charge transportation material, and a binding resin in the same layer ] type composition.

[0194] Hereafter, a laminating type photosensitive layer is explained.

[0195] The charge transporting bed in this invention can apply the solution which distributed / dissolved charge transportation material with the binding resin at the solvent, and can be dried and formed.

[0196] As a binding resin used with the above-mentioned charge transportation material, the resin for charge transporting beds used conventionally can be used, for example, polyester, a polycarbonate, a polyarylate, a polymethacrylic acid ester, polystyrene, etc. are mentioned. As for the thickness of a charge transporting bed, it is desirable that it is 1-50 micrometers, and it is especially desirable that it is 5-30 micrometers.

[0197] When the ratio of the charge transportation material in this case and the above-mentioned binding resin sets both total mass to 100, as for the mass of charge transportation material, 10-100 are desirable, and are preferably chosen suitably in 20-100.

[0198] Although it is desirable to apply the solution which distributed charge generating material to the binding resin, and to form by drying, you may form the charge generating layer in this invention by carrying out the vacuum evaporation only of the charge generating material.

[0199] As a charge generating material, the amorphous silicon of a publication etc. is mentioned to a selenium-tellurium, a pyrylium, a thia pyrylium system color, various kinds of central metals and crystal system, the phthalocyanine compound that specifically has crystallized types, such as alpha, beta, gamma, epsilon, and an X type, an anthanthrone pigment, a JIBENZU pyrene quinone pigment, a pyran TRON pigment, a tris azo pigment, a disazo pigment, a monoazo pigment, an indigo pigment, a Quinacridone pigment, an unsymmetrical kino cyanine pigment, a kino cyanine

[0200] 0.3 to 4 times, with the binding resin and solvent of an amount, methods, such as a homogenizer, ultrasonic distribution, a ball mill, a vibration ball mill, a sand mill, attritor, and a roll mill, are sufficient as a charge generating layer, and it distributes the aforementioned charge generating material, applies dispersion liquid, and is dried and formed, or is formed as films of independent composition, such as a vacuum evaporation film of the aforementioned charge generating material. As for the thickness, it is desirable that it is 5 micrometers or less, and it is especially desirable that it is the range which is 0.1-2 micrometers.

[0201] As for the example in the case of using a binding resin, the polymer and the copolymer,



the polyvinyl alcohol, the polyvinyl acetal, the polycarbonate, the polyester, the polysulfone, the polyphenylene oxide, the polyurethane, a cellulosic resin, phenol resin, melamine resin, silicone resin, an epoxy resin, etc. of vinyl compounds, such as styrene, vinyl acetate, a vinyl chloride, an acrylic ester, a methacrylic ester, a fluoride vinylidene, and triffe RUORO ethylene, are mentioned.

[0202] When a photosensitive layer is a monolayer, the solution which distributed and dissolved the above-mentioned charge generating material and with a molecular weight of 350 or more charge transportation material in the above-mentioned binding resin can be applied, and it can form by drying.

[0203] Various additives can be added in the photosensitive layer in this invention. These additives are degradation inhibitors, such as an antioxidant and an ultraviolet ray absorbent, and a \*\* agent and others, such as a fluorine atom content resin particle.

[0204] Independent or the metal which applied and prepared the conductive layer with the binding resin, plastic film, paper, etc. are mentioned in the thing and the conductive matter which deposited what laminated metallic foils, such as what fabricated metals and alloys, such as aluminum, copper, chromium, nickel, zinc, and stainless steel, a drum or in the shape of a sheet, aluminum, and copper, in plastic film that what is necessary is just what has conductivity as a base material of an electrophotography photo conductor, aluminum, indium oxide, the tin oxide, etc. to plastic film.

[0205] In this invention, a conductive support surface may be chemically processed by the reaction with a chemical conversion, i.e., an acid, or an alkaline-water solution, and an insoluble coat may be formed.

[0206] On a conductive base material, an under-coating layer with a barrier function and an adhesion function can be prepared. An under-coating layer is formed for an adhesive improvement of a photosensitive layer, coating nature improvement, protection of a base material, covering of the defect on a base material, the charge pouring nature improvement from a base material, the protection to the electrical breakdown of a photosensitive layer, etc.

[0207] As a material of an under-coating layer, for example A polyethylene resin, acrylic resin, Methacrylic resin, polyamide resin, vinyl chloride resin, a vinyl acetate resin, Phenol resin, polycarbonate resin, a polyurethane resin, polyimide resin, A vinylidene chloride resin, a polyvinyl-acetal resin, a vinyl chloride vinyl acetate copolymer, A fusibility Nylon a polyvinyl alcohol resin, water-soluble polyester resin, and alcoholic, A nitrocellulose, casein, gelatin, the poly glutamic acid, starch, Resins, such as starch acetate, amino starch, a polyacrylic acid, and a polyacrylamide, Or independent or two sorts or more can be mixed, and metal organic compounds, such as an organometallic compound containing a silane coupling agent, a zirconium, titanium, aluminum, manganese, etc., can be used. It dissolves in the solvent suitable for each, and these are applied on a base material. As thickness in that case, 0.1-5 micrometers is desirable.

[0208] As the method of application of these each class, although the dip coating method, the spray coating method, the curtain coating method, the spin coating method, etc. are learned for example, the dip coating method from the point of efficiency/productivity is desirable. Moreover, the well-known film production method of of vacuum evaporation, and plasma and others can choose suitably.

[0209] The outline composition of the electrophotography equipment using the process cartridge which has the electrophotography photo conductor of this invention in drawing 1 is shown.

[0210] In drawing, 1 is the electrophotography photo conductor of a drum-like this invention,



and a rotation drive is carried out with a predetermined peripheral velocity in the direction of an arrow a center [ a shaft 2 ]. In rotation process, the electrophotography photo conductor 1 receives uniform electrification of positive or negative predetermined potential in the peripheral surface by the primary electrification means 3, and receives the exposure light 4 by which the emphasis modulation was subsequently carried out corresponding to the time series electrical-and-electric-equipment digital image signal of image information to be outputted from exposure meanses (un-illustrating), such as slit exposure and laser-beam scanning exposure. In this way, the electrostatic latent image corresponding to the target image information is formed one by one to the peripheral surface of the electrophotography photo conductor 1.

[0211] Subsequently the toner development of the formed electrostatic latent image is carried out by the development means 5, and the toner picture by which formation support is carried out is imprinted one by one by the imprint means 6 on the front face of the electrophotography photo conductor 1 by the imprint material 7 to which was taken out from the non-illustrated feed section and paper was fed between the electrophotography photo conductor 1 and the imprint means 6 from it synchronizing with rotation of the electrophotography photo conductor 1.

[0212] The imprint material 7 which received the imprint of a toner picture is printed out out of equipment as an image formation object (a print, copy) by dissociating from an electrophotography photo conductor side, being introduced to the image fixing means 8, and receiving image fixing.

[0213] The front face of the electrophotography photo conductor 1 after an image imprint is used for repeat image formation, after a pure side is formed by the cleaning means 9 in response to removal of the imprint remaining toner and electric discharge processing is further carried out by the pre-exposure light 10 from a pre-exposure meanses (un-illustrating). In addition, when the primary electrification means 3 is a contact electrification means using the electrification roller etc., a pre-exposure is not necessarily required.

[0214] In this invention, two or more things may be dedicated to a container 11 among the components of the above-mentioned electrophotography photo conductor 1, the primary electrification means 3, the development means 5, and cleaning means 9 grade, and it may combine with one as a process cartridge, and may constitute, and this process cartridge may be constituted free [ attachment and detachment ] to main parts of electrophotography equipment, such as a copying machine and a laser beam printer. For example, in support of at least one of the primary electrification means 3, the development means 5, and the cleaning meanses 9, it can cartridge-ize to one with the electrophotography photo conductor 1, and can consider as the process cartridge which can be freely detached and attached on the main part of equipment using the guidance meanses 12, such as a rail of the main part of equipment.

[0215] Moreover, the exposure light 4 is a light irradiated by the scan of a laser beam which reads and signal-izes a manuscript by the reflected light from a manuscript, the transmitted light, or the sensor, and is performed according to this signal, the drive of an LED array, the drive of a liquid crystal shutter array, etc., when electrophotography equipment is a copying machine and a printer.

[0216] It not only uses the electrophotography photo conductor of this invention for an electrophotography copying machine, but it can use it for electrophotography applicable fields, such as a laser beam printer, a CRT printer, an LED printer, FAX, a liquid crystal printer, and laser platemaking, widely.

[0217]



## EXAMPLES

[Example] Hereafter, according to an example, this invention is explained still in detail. In addition, the "section" in an example expresses the mass section.

[0218] (Example 1) The paint for conductive layers was first prepared in the following procedures. With the sand-mill equipment using  $\phi 1\text{mm}$  glass bead, it distributed for 2 hours and the conductive titanium oxide fine-particles 50 section covered with the tin oxide containing the antimony oxide of 10 mass %, the phenol resin 25 section, the methyl-cellosolve 20 section, the methanol 5 section, and the silicone-oil (poly dimethylsiloxane polyoxyalkylene copolymer, average molecular weight 3000) 0.002 section were prepared. Thickness formed the conductive layer which is 20 micrometers by applying this paint by the dip painting cloth method on a  $\phi 30\text{mm}$  aluminum cylinder, and drying for 30 minutes at 140 degrees C.

[0219] Next, the N-methoxymethyl-ized nylon 5 section was dissolved into the methanol 95 section, and the paint for interlayers was prepared. Thickness formed the interlayer who is 0.6 micrometers by applying this paint by the dip coating method on the aforementioned conductive layer, and drying for 20 minutes at 100 degrees C.

[0220] Next, the Bragg angle ( $2\theta \approx 0.2$  degree) in characteristic X ray diffraction of CuK $\alpha$  distributed the oxy-titanium phthalocyanine which has 9.0 degrees, 14.2 degrees, 23.9 degrees, and a peak strong against 27.1 degrees for 2 hours with the sand-mill [ section / cyclohexanone 35 / the three sections, the polyvinyl-butyral (tradename : id REKKU BM 2, Sekisui Chemical Co., Ltd. make) 3 section, and ] equipment using  $\phi 1\text{mm}$  glass bead, added the ethyl-acetate 60 section after that, and prepared the paint for charge generating layers. Thickness formed the charge generating layer which is 0.2 micrometers by applying this paint by the dip painting cloth method on the aforementioned interlayer, and drying for 10 minutes at 50 degrees C.

[0221] Subsequently, it is the polycarbonate resin 10 section which has the repeat unit of the ten sections and the following structure expression (21) for example No.of compound 54 as a charge transportation material [0222]

[Formula 121]

It dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 30 section, and the application liquid for charge transporting beds was prepared. Thickness formed the charge transporting bed which is 20 micrometers by carrying out dip coating of this application liquid on the aforementioned charge generating layer, and drying at 110 degrees C for 1 hour.

[0223] Subsequently, the electron hole transportability compound 60 section of example No.of compound 6 was dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 50 section, and the paint for protective layers was prepared. By applying this paint on a previous charge transporting bed by the spray coating method, irradiating an electron ray on condition that 150kV of acceleration voltage, and dosage 30Mrad, and hardening a resin, thickness formed the protective layer which is 5 micrometers, and obtained the





electrophotography photo conductor.

[0224] LBP-SX by Canon, Inc. was equipped with the produced electrophotography photo conductor, and the initial electrophotography property was evaluated. The early photo conductor property [optical attenuation sensitivity (quantity of light required in order to make -200V carry out optical attenuation by dark space potential-700V setup), and a rest potential  $V_{sl}$  (potential when irradiating the quantity of light 3 times the quantity of light of optical attenuation sensitivity)] was measured and searched for in the environment under ordinary temperature normal-relative-humidity environment (23 degrees C / 50%RH). Then, environment was changed into the bottom (H/H) of high-humidity/temperature (32 degrees C / 85%RH), and the amount of change from under the ordinary temperature normal-relative-humidity environment of  $V_l$  ( $\Delta V_l$ ) was measured. A result is shown in Table 3.

[0225] (Examples 2-22 and examples 1-4 of comparison) The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced the charge transportation material in the electron hole transportability compound in the protective layer of an example 1, or a photosensitive layer with, as shown in Table 3. The result is shown in Table 3.

[0226] (Example 23) Example No. of compound 54 of the charge transportation material of an example 1 They are the ten sections The example No. of compound 198 section, and example No. of compound 54 The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced with the two sections. A result is shown in Table 4.

[0227] (Example 24) Example No. of compound 54 of the charge transportation material of an example 1 They are the ten sections The example No. of compound 53 section, and example No. of compound 54 The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced with the seven sections. A result is shown in Table 4.

[0228] (Example 25) Example No. of compound 54 of the charge transportation material of an example 1 They are the ten sections The example No. of compound 57 section, and example No. of compound 54 The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced with the three sections. A result is shown in Table 4.

[0229] (Example 26) The photo conductor base material for electrophotography was first obtained in the following procedures. After having prepared phi30mm aluminum cylinder, having maintained at the temperature of 40 degrees C the non clo mate chemical-conversion agent liquid (tradename : PARCO-TO 3753, by Nihon Parkerizing Co., Ltd.) which contains titanium as a phytic acid and a metal as organic phosphoric acid, immersing the above-mentioned aluminum cylinder into this liquid and performing a chemical conversion for 1 minute, the air drying was washed and carried out with pure water, and it considered as the base material.

[0230] The charge generating layer, the charge transporting bed, and the protective layer were formed and evaluated like the example 1 on the above-mentioned base material. A result is shown in Table 4.

[0231] (Examples 27 and 28) The electrophotography photo conductor was produced and evaluated like the example 26 except having replaced example No. of compound 54 of the charge transportation material of an example 26 with example No. of compound 29, and example No. of compound 68. A result is shown in Table 4.

[0232] (Example 29) Honing processing of the phi30mm aluminum cylinder was carried out, and what carried out ultrasonic backwashing by water was made into the conductive base material.



[0233] Next, the 85% butanol solution (Kanto chemistry company make) 64 section (0.06 mols) of zirconium tetrapod-n-butoxide and the titanium tetrapod-n-butoxide (KISHIDA chemistry company make) 22 section (0.14 mols) are dropped at the methoxy ethanol 160 section, and the mixed solution of the methoxy ethanol / pure water = 160 section / 11 section is added further. Furthermore, after the solution which added the acetylacetone 20 section to the methanol 200 section was dropped, thickness formed the interlayer who is 0.3 micrometers by carrying out the dip painting cloth of the interlayer application liquid which mixed and obtained the 10 mass % methanol liquid 55 section of hydroxypropylcellulose (the Tokyo Chemicals industrial company make) on an aluminum cylinder base material, and carrying out stoving for 15 minutes at 120 degrees C.

[0234] The charge generating layer, the charge transporting bed, and the protective layer were formed and evaluated like the example 1 on the above-mentioned interlayer. A result is shown in Table 4.

[0235] (Examples 30 and 31) The electrophotography photo conductor was produced and evaluated like the example 29 except having replaced example No. of compound 54 of the charge transportation material of an example 29 with example No. of compound 32, and example No. of compound 40. A result is shown in Table 4.

[0236] (Example 32) The electrophotography photo conductor was produced and evaluated like the example 2 except having prepared the application liquid for charge transporting beds as follows. A result is shown in Table 4.

[0237] Example No. of compound 54 of charge transportation material The 16 sections, the polycarbonate resin 4 section which has the repeat unit of the aforementioned structure expression (21), and the antioxidant (tradename : IRUGA NOx 1330, product made from Ciba-Geigy) 1 section were dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 30 section, and the application liquid for charge transporting beds was prepared.

[0238] (Example 33) The electrophotography photo conductor was produced and evaluated like the example 1 except having prepared the application liquid for charge transporting beds as follows. A result is shown in Table 4.

[0239] Example No. of compound 98 of charge transportation material The three sections and example No. of compound 89 The one section, the polycarbonate resin 16 section which has the repeat unit of the aforementioned structure expression (21), the antioxidant (tradename : SumilizerGS, Sumitomo Chemical Co., Ltd. make) 0.5 section, and the antioxidant (tradename : IRGAFOS- 168, Ciba-Geigy Japan make) 0.5 section were dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 30 section, and the application liquid for charge transporting beds was prepared.

[0240] When with a molecular weight of less than 350 charge transportation material was used to a potential property and environmental capability being good if with a molecular weight of 350 or more charge transportation material is used as shown in the example of comparison as shown in the example of Table 3 and 4, there were some which produced a sensitivity fall and elevation of a rest potential, and there was also a big thing of environmental variation.

[0241]

[Table 3]



[0242]  
[Table 4]

[0243]

[Effect of the Invention] According to this invention, electrophotography properties, like sensitivity is good, there is little elevation of a rest potential, and the potential change by environment is small are very good, and were able to offer the electrophotography photo conductor which can demonstrate the always stabilized performance.

[0244] Moreover, naturally the effect of the above-mentioned electrophotography photo conductor is demonstrated also in the process cartridge and electrophotography equipment which have the electrophotography photo conductor, and high definition is maintained for a long period of time.



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## PRIOR ART

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[Description of the Prior Art] Conventionally, inorganic photoconductivity material, such as a selenium, a cadmium sulfide, and a zinc oxide, was widely used for the electrophotography photo conductor. On the other hand, as an electrophotography photo conductor using an organic photoconductivity material, they are the photoconductivity polymer represented by Poly N-vinyl carbazole (PVC) and 2 and 5-screw (p-diethylaminophenyl) - 1, 3, the thing using a low-molecular organic photoconductivity material like 4-OKISA diazole, the thing that combined this organic photoconductivity material, various colors, and pigment are known further.

[0003] Since the electrophotography photo conductor using an organic photoconductivity material is good and membrane formation nature can produce it by coating, it has the advantage which productivity can provide with a cheap high electrophotography photo conductor extremely. Moreover, it had the advantage with a sensitization wavelength region controllable free by selection of a color, a pigment, etc. to be used, and a broad examination has so far been made. The improvement remarkable in the sensitivity and endurance which carried out the laminating of the charge generating layer which especially contained the organic photoconductivity color and the pigment recently, and the charge transporting bed containing photoconductivity polymer or a low-molecular organic photoconductivity material and which were made the fault of the conventional organic electrophotography photo conductor by development of the electrophotography photo conductor of a functional discrete type is made, and this is becoming in use [ an organic electrophotography photo conductor ].

[0004] On the other hand, it is required the sensitivity according to the electrophotography process applied to an electrophotography photo conductor with a natural thing, the electrical property, and that it should have the optical property further. If it is in the electrophotography photo conductor by which repeat use is carried out especially, electric and since mechanical force external is applied directly, endurance over them, such as an imprint to electrification, picture exposure, a toner development, and paper and cleaning processing, is required of the electrophotography photo conductor front face. Specifically, surface degradation by the endurance and electrification over the surface wear and generating of a blemish by \*\*\*\* is mentioned, and the fall of imprint efficiency or slipping nature and the endurance over degradation of electrical properties, such as a sensitivity fall and a potential fall, are also required further in more detail.

[0005] Generally, the front face of an electrophotography photo conductor is a thin resin layer, and the property of a resin is very important for it. Although it considers as the resin with which it is satisfied of above-mentioned terms and conditions to some extent and acrylic resin, polycarbonate resin, etc. are put in practical use in recent years, when it is not satisfied [ with these resins ] of all the properties that were mentioned above and it attains high durability-ization of an electrophotography photo conductor especially, it is hard to say that the coat degree of hardness of this resin is sufficiently high. Even when these resins were used as a resin for surface-layer formation, wear of a surface layer took place repeatedly at the time of use, and there was a trouble that a blemish occurred further.

[0006] Furthermore, although low molecular weight compounds, such as charge transportation material, are added in many cases comparatively in large quantities from the demand to high-sensitivity-izing of an organic electrophotography photo conductor in recent years, film intensity





falls remarkably by the operation like a plasticizer of these low-molecular-weight material in this case, and wear and blemish generating of the surface layer at the time of repeat use pose a problem further. Moreover, when saving an electrophotography photo conductor over a long period of time, the above-mentioned low molecular weight constituent deposited, and the problem of carrying out layer separation is also generated.

[0007] As a means to solve these troubles, the attempt which uses the resin of hardenability as a resin for charge transporting beds is indicated by JP,2-127652,A etc. Thus, \*\*\*\*\*-proof and \*\*\*\*-proof at the time of the increase of a mechanical strength and repeat use improve greatly by using the resin of hardenability for the resin for charge transporting beds, hardening a charge transporting bed and constructing a bridge. However, even if it uses a hardenability resin, since a low molecular weight constituent acts as a plasticizer into a binding resin to the last, the problem of a deposit which was described previously, or layer separation is not fundamental solution.

[0008] Moreover, in the charge transporting bed which consists of an organic charge transportation material and a binding resin, by the time it satisfies both -- charge transportation ability is not enough and the rise of a rest potential is seen at the time of repeat use -- to a hardenability resin with a degree of hardness high enough greatly [ the dependence over the resin of charge transportation ability ], it will not have resulted.

[0009] Moreover, it sets to JP,5-216249,A, JP,7-72640,A, etc. Although the electrophotography photo conductor which the charge transfer layer was made to contain the monomer which has a carbon-carbon double bond, was made to react by the carbon-carbon double bond, heat, or luminous energy of charge transfer material, and formed the charge transfer layer hardening film is indicated, since charge transportation material is only fixed by the polymer main frame in the shape of a pendant and cannot fully eliminate a previous plastic operation, a mechanical strength is not enough. Moreover, if concentration of charge transportation material is made high for improvement in charge transportation ability, crosslinking density cannot become low and cannot secure sufficient mechanical strength. Furthermore, we are anxious also about the influence on the electrophotography property of initiators needed at the time of a polymerization.

[0010] Moreover, it sets to JP,8-248649,A etc. as another solution means. although it is effective to a deposit or layer separation as compared with a conventional molecular-dispersion type charge transporting bed although the electrophotography photo conductor which the basis which has charge transportation ability was introduced [ photo conductor ] and made the charge transporting bed form into a thermoplastic macromolecule principal chain is indicated, and a mechanical strength also improves, it is thermoplastics to the last, and there is a limitation in the mechanical strength and it is hard to say that it enough-comes out in respect of the handling including the solubility of a resin etc., or productivity

[0011] Making into the background what was described above, this invention persons repeated the examination for attaining coexistence of a high mechanical strength and charge transportation ability. Consequently, it was checked that coexistence of a mechanical strength and charge transportation ability is mostly attained with the electrophotography photo conductor containing the compound to which the polymerization of the electron hole transportability compound which has two or more chain pile affinity functional groups in the same molecule was carried out.

[0012] However, although the mechanical strength improved by using the electron hole transportability compound which has two or more chain pile affinity functional groups in the same molecule when this was used as a protective layer, when a photosensitive layer was an organic system photosensitive layer, sensitivity might not fully be obtained and the rise of a rest



potential might be seen. Moreover, potential was changed with an environmental change and the stable potential property could not be acquired.

[0013] In order to offer the more excellent electrophotography photo conductor with high-definition-izing in recent years and a raise in durability, these problems surely needed to be solved.

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## EXAMPLE

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[Example] Hereafter, according to an example, this invention is explained still in detail. In addition, the "section" in an example expresses the mass section.

[0218] (Example 1) The paint for conductive layers was first prepared in the following procedures. With the sand-mill equipment using  $\phi 1$  mm glass bead, it distributed for 2 hours and the conductive titanium oxide fine-particles 50 section covered with the tin oxide containing the antimony oxide of 10 mass %, the phenol resin 25 section, the methyl-cellosolve 20 section, the methanol 5 section, and the silicone-oil (poly dimethylsiloxane polyoxyalkylene copolymer, average molecular weight 3000) 0.002 section were prepared. Thickness formed the conductive layer which is 20 micrometers by applying this paint by the dip painting cloth method on a  $\phi 30$  mm aluminum cylinder, and drying for 30 minutes at 140 degrees C.

[0219] Next, the N-methoxymethyl-ized nylon 5 section was dissolved into the methanol 95 section, and the paint for interlayers was prepared. Thickness formed the interlayer who is 0.6 micrometers by applying this paint by the dip coating method on the aforementioned conductive layer, and drying for 20 minutes at 100 degrees C.

[0220] Next, the Bragg angle ( $2\theta \times 0.2$  degree) in characteristic X ray diffraction of CuK $\alpha$  distributes the oxy-titanium phthalocyanine which has 9.0 degrees, 14.2 degrees, 23.9 degrees, and a peak strong against 27.1 degrees for 2 hours with the sand-mill [ section / cyclohexanone 35 / the three sections, the polyvinyl-butyril (trade name : S REKKU BM 2, Sekisui Chemical Co., Ltd. make) 3 section, and ] equipment using  $\phi 1$  mm glass bead. The ethyl-acetate 60 section was added after that, and the paint for charge generating layers was prepared. Thickness formed the charge generating layer which is 0.2 micrometers by applying this paint by the dip painting cloth method on the aforementioned interlayer, and drying for 10 minutes at 50 degrees C.

[0221] Subsequently, the polycarbonate resin 10 section which has the repeat unit of the ten sections and the following structure expression (21) for example No. of compound 54 as a charge transportation material [0222]

[Formula 121]

It dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 30 section, and the application liquid for charge transporting beds was prepared. Thickness formed



the charge transporting bed which is 20 micrometers by carrying out dip coating of this application liquid on the aforementioned charge generating layer, and drying at 110 degrees C for 1 hour.

[0223] Subsequently, the electron hole transportability compound 60 section of example No. of compound 6 was dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 50 section, and the paint for protective layers was prepared. By applying this paint on a previous charge transporting bed by the spray coating method, irradiating an electron ray on condition that 150kV of acceleration voltage, and dosage 30Mrad, and hardening a resin, thickness formed the protective layer which is 5 micrometers, and obtained the electrophotography photo conductor.

[0224] LBP-SX by Canon, Inc. was equipped with the produced electrophotography photo conductor, and the initial electrophotography property was evaluated. The early photo conductor property [optical attenuation sensitivity (quantity of light required in order to make -200V carry out optical attenuation by dark space potential-700V setup), and a rest potential  $V_{sl}$  (potential when irradiating the quantity of light 3 times the quantity of light of optical attenuation sensitivity)] was measured and searched for in the environment under ordinary temperature normal-relative-humidity environment (23 degrees C / 50%RH). Then, environment was changed into the bottom (H/H) of high-humidity/temperature (32 degrees C / 85%RH), and the amount of change from under the ordinary temperature normal-relative-humidity environment of  $V_l$  ( $\Delta V_l$ ) was measured. A result is shown in Table 3.

[0225] (Examples 2-22 and examples 1-4 of comparison) The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced the charge transportation material in the electron hole transportability compound in the protective layer of an example 1, or a photosensitive layer with, as shown in Table 3. The result is shown in Table 3.

[0226] (Example 23) Example No. of compound 54 of the charge transportation material of an example 1 They are the ten sections The example No. of compound. 198 section, and example No. of compound 54 The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced with the two sections. A result is shown in Table 4.

[0227] (Example 24) Example No. of compound 54 of the charge transportation material of an example 1 They are the ten sections The example No. of compound. 53 section, and example No. of compound 54 The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced with the seven sections. A result is shown in Table 4.

[0228] (Example 25) Example No. of compound 54 of the charge transportation material of an example 1 They are the ten sections The example No. of compound. 57 section, and example No. of compound 54 The electrophotography photo conductor was produced and evaluated like the example 1 except having replaced with the three sections. A result is shown in Table 4.

[0229] (Example 26) The photo conductor base material for electrophotography was first obtained in the following procedures. After having prepared  $\phi 30$ mm aluminum cylinder, having maintained at the temperature of 40 degrees C the non clo mate chemical-conversion agent liquid (tradename : PARCO-TO 3753, by Nihon Parkerizing Co., Ltd.) which contains titanium as a phytic acid and a metal as organic phosphoric acid, immersing the above-mentioned aluminum cylinder into this liquid and performing a chemical conversion for 1 minute, the air drying was washed and carried out with pure water, and it considered as the base material.

[0230] The charge generating layer, the charge transporting bed, and the protective layer were



formed and evaluated like the example 1 on the above-mentioned base material. A result is shown in Table 4.

[0231] (Examples 27 and 28) The electrophotography photo conductor was produced and evaluated like the example 26 except having replaced example No. of compound 54 of the charge transportation material of an example 26 with example No. of compound 29, and example No. of compound 68. A result is shown in Table 4.

[0232] (Example 29) Honing processing of the  $\phi 30$  mm aluminum cylinder was carried out, and what carried out ultrasonic backwashing by water was made into the conductive base material.

[0233] Next, the 85% butanol solution (Kanto chemistry company make) 64 section (0.06 mols) of zirconium tetrapod-n-butoxide and the titanium tetrapod-n-butoxide (KISHIDA chemistry company make) 22 section (0.14 mols) are dropped at the methoxy ethanol 160 section, and the mixed solution of the methoxy ethanol / pure water = 160 section / 11 section is added further. Furthermore, after the solution which added the acetylacetone 20 section to the methanol 200 section was dropped, thickness formed the interlayer who is 0.3 micrometers by carrying out the dip painting cloth of the interlayer application liquid which mixed and obtained the 10 mass % methanol liquid 55 section of hydroxypropylcellulose (the Tokyo Chemicals industrial company make) on an aluminum cylinder base material, and carrying out stoving for 15 minutes at 120 degrees C.

[0234] The charge generating layer, the charge transporting bed, and the protective layer were formed and evaluated like the example 1 on the above-mentioned interlayer. A result is shown in Table 4.

[0235] (Examples 30 and 31) The electrophotography photo conductor was produced and evaluated like the example 29 except having replaced example No. of compound 54 of the charge transportation material of an example 29 with example No. of compound 32, and example No. of compound 40. A result is shown in Table 4.

[0236] (Example 32) The electrophotography photo conductor was produced and evaluated like the example 2 except having prepared the application liquid for charge transporting beds as follows. A result is shown in Table 4.

[0237] Example No. of compound 54 of charge transportation material The 16 sections, the polycarbonate resin 4 section which has the repeat unit of the aforementioned structure expression (21), and the antioxidant (tradename : IRUGA NOx 1330, product made from Ciba-Geigy) 1 section were dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 30 section, and the application liquid for charge transporting beds was prepared.

[0238] (Example 33) The electrophotography photo conductor was produced and evaluated like the example 1 except having prepared the application liquid for charge transporting beds as follows. A result is shown in Table 4.

[0239] Example No. of compound 98 of charge transportation material The three sections and example No. of compound 89 The one section, the polycarbonate resin 16 section which has the repeat unit of the aforementioned structure expression (21), the antioxidant (tradename : SumilizerGS, Sumitomo Chemical Co., Ltd. make) 0.5 section, and the antioxidant (tradename : IRGAFOS- 168, Ciba-Geigy Japan make) 0.5 section were dissolved into the mixed solvent of the monochlorobenzene 50 section / dichloromethane 30 section, and the application liquid for charge transporting beds was prepared.

[0240] When with a molecular weight of less than 350 charge transportation material was used to a potential property and environmental capability being good if with a molecular weight of 350





or more charge transportation material is used as shown in the example of comparison as shown in the example of Table 3 and 4, there were some which produced a sensitivity fall and elevation of a rest potential, and there was also a big thing of environmental variation.

[0241]

[Table 3]

[0242]

[Table 4]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the example of the outline composition of the electrophotography equipment using the process cartridge which has the electrophotography photo conductor of this invention.

[Description of Notations]

1 Electrophotography Photo Conductor

2 Shaft

3 Electrification Means

4 Exposure Light

5 Development Means

6 Imprint Means

7 Imprint Material

8 Fixing Means

9 Cleaning Means

10 Pre-exposure Light

11 Process Cartridge Container

12 Guidance Means





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**ELECTROPHOTOGRAPHIC  
PHOTORECEPTOR,  
PROCESS CARTRIDGE AND  
ELECTROPHOTOGRAPHIC  
DEVICE**

(57) Abstract:

**PROBLEM TO BE SOLVED:** To provide an electrophotographic photoreceptor which is good in sensitivity in spite of formation of a protective layer, is little in an increase of residual potential and small in potential fluctuation by environment at change and makes it possible obtain stable electrophotographic characteristics, a process cartridge having the electrophotographic photoreceptor and an electrophotographic device.

**SOLUTION:** The electrophotographic photoreceptor which has a conductive



substrate, a photosensitive layer and a protective layer, has the protective layer containing a compound polymerized with a hole transferable component having 2 chain polymerizable functional groups within the same molecule and has the photosensitive layer containing a charge transfer material of 350 in molecular weight, the process cartridge having the electrophotographic photoreceptor and the electrophotographic device.

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(54) 【発明の名称】 電子写真感光体、プロセスカートリッジ及び電子写真装置

(57) 【要約】

【課題】 保護層を形成しても感度が良好であり、残留電位の上昇が少なく、環境変化による電位変動が小さく、安定した電子写真特性が得られる電子写真感光体、その電子写真感光体を有するプロセスカートリッジ及び電子写真装置を提供することにある。

【解決手段】 導電性支持体、感光層及び保護層を有する電子写真感光体において、該保護層が同一分子内に2つ以上の連鎖重合性官能基を有する正孔輸送性化合物を重合した化合物を含有し、かつ該感光層が分子量350以上の電荷輸送材料を含有することを特徴とする電子写真感光体、その電子写真感光体を有するプロセスカートリッジ及び電子写真装置。

## 【特許請求の範囲】

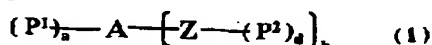
【請求項1】 導電性支持体、感光層及び保護層を有する電子写真感光体において、該保護層が同一分子内に二つ以上の連鎖重合性官能基を有する正孔輸送性化合物を重合した化合物を含有し、かつ該感光層が分子量350以上の電荷輸送材料を含有することを特徴とする電子写真感光体。

【請求項2】 前記感光層が分子量350以上700以下の電荷輸送材料を含有する請求項1に記載の電子写真感光体。

【請求項3】 前記電荷輸送材料の割合が、前記感光層が含有する全電荷輸送材料に対し50質量%以上である請求項1又は2に記載の電子写真感光体。

【請求項4】 前記連鎖重合性官能基を有する正孔輸送性化合物が、下記一般式(1)である請求項1～3のいずれかに記載の電子写真感光体。

## 【化1】

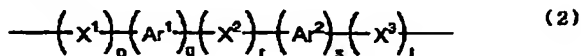


(式中、Aは正孔輸送性基を示す。P<sup>1</sup>及びP<sup>2</sup>は連鎖重合性官能基を示す。P<sup>1</sup>とP<sup>2</sup>は同一でも異なっても良い。Zは置換基を有しても良い有機基を示す。a、b及びdは0以上の整数を示し、a+b×dは2以上の整数を示す。また、aが2以上の場合P<sup>1</sup>は同一でも異なってもよく、dが2以上の場合、Z及びP<sup>2</sup>は同一でも異なってもよい)

【請求項5】 上記一般式(1)のZが置換基を有してもよいアルキレン基、置換基を有してもよいアリーレン基、CR<sup>1</sup>=CR<sup>2</sup>(R<sup>1</sup>及びR<sup>2</sup>は置換基を有してもよいアルキル基、置換基を有してもよいアリール基又は水素原子を示し、R<sup>1</sup>及びR<sup>2</sup>は同一でも異なってもよい)、C=O、S=O、SO<sub>2</sub>、酸素原子又は硫黄原子より一つあるいは任意に組み合わされた有機基を示す請求項4のいずれかに記載の電子写真感光体。

【請求項6】 上記一般式(1)のZが下記一般式(2)で示される請求項4に記載の電子写真感光体。

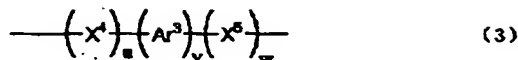
## 【化2】



(式中、X<sup>1</sup>～X<sup>3</sup>は置換基を有してもよいアルキレン基、(CR<sup>3</sup>=CR<sup>4</sup>)<sub>n1</sub>、C=O、S=O、SO<sub>2</sub>、酸素原子又は硫黄原子を示し、Ar<sup>1</sup>～Ar<sup>2</sup>は置換基を有してもよいアリーレン基を示す。R<sup>3</sup>及びR<sup>4</sup>は置換基を有してもよいアルキル基、置換基を有してもよいアリール基又は水素原子を示し、R<sup>3</sup>及びR<sup>4</sup>は同一でも異なってもよい。m<sup>1</sup>は1～5の整数、p～tは0～10の整数を示す。但し、p～tは同時に0であることはない。)

【請求項7】 上記一般式(1)のZが下記一般式(3)で示される請求項4に記載の電子写真感光体。

## 【化3】

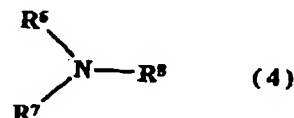


(式中、Ar<sup>3</sup>は置換基を有してもよいアリーレン基を示す。X<sup>4</sup>及びX<sup>5</sup>は(CH<sub>2</sub>)<sub>n2</sub>、(CH=CR<sup>5</sup>)<sub>n3</sub>、C=O、又は酸素原子を示す。R<sup>5</sup>は置換基を有してもよいアルキル基、置換基を有してもよいアリール基又は水素原子を示し、m<sup>2</sup>は1～10の整数、m<sup>3</sup>は1～5の整数、u～wは0～10の整数を示す。但し、u～wは同時に0であることはない)

【請求項8】 同一分子内に二つ以上の連鎖重合性官能基を有する正孔輸送性化合物の化合物の酸化電位が0.4～1.2(V)である請求項1～7のいずれかに記載の電子写真感光体。

【請求項9】 上記一般式(1)で、AとP<sup>1</sup>及びZとの結合部位を水素原子に置き換えた正孔輸送性化合物が下記一般式(4)で示される請求項4～8のいずれかに記載の電子写真感光体。

## 【化4】

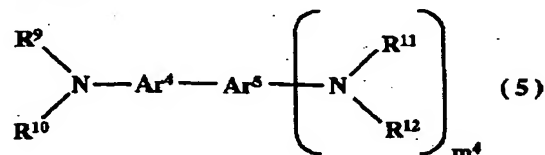


(式中、R<sup>6</sup>、R<sup>7</sup>及びR<sup>8</sup>は置換基を有してもよいアルキル基、置換基を有してもよいアラルキル基又は置換基を有してもよいアリール基を示す。但し、少なくともそのうち2つはアリール基を示す。また、R<sup>6</sup>、R<sup>7</sup>及びR<sup>8</sup>はそれぞれ同一であっても異なってもよい)

【請求項10】 上記一般式(4)のR<sup>6</sup>、R<sup>7</sup>及びR<sup>8</sup>が置換基を有してもよいアリール基である請求項9に記載の電子写真感光体。

【請求項11】 上記一般式(1)で、AとP<sup>1</sup>及びZとの結合部位を水素原子に置き換えた正孔輸送性化合物が下記一般式(5)で示される請求項4～8のいずれかに記載の電子写真感光体。

## 【化5】



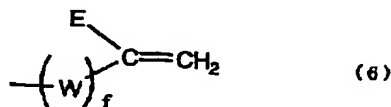
(式中、R<sup>9</sup>～R<sup>12</sup>は置換基を有してもよいアルキル基、置換基を有してもよいアラルキル基又は置換基を有してもよいアリール基を示す。また、R<sup>9</sup>～R<sup>12</sup>はそれぞれ同一であっても異なってもよい。Ar<sup>4</sup>及びAr<sup>5</sup>は置換基を有してもよいアリーレン基を示し、それぞれ同一でも異なってもよい。m<sup>4</sup>は0又は1を示す)



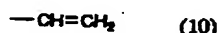
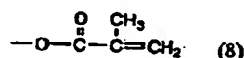
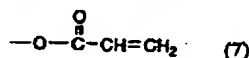
【請求項12】 上記一般式(5)の $m^1$ が1であり、かつ $R^9 \sim R^{12}$ が置換基を有してもよいアリール基である請求項11に記載の電子写真感光体。

【請求項13】 連鎖重合性官能基 $P^1$ 、 $P^2$ の一方又は両方が下記一般式(6)で示される不飽和重合性官能基である請求項4～12のいずれかに記載の電子写真感光体。

【化6】



(式中、Eは水素原子、ハロゲン原子、置換基を有してもよいアルキル基及び置換基を有してもよいアリール基、シアノ基、ニトロ基、アルコキシ基、 $-\text{COOR}^{13}$  ( $R^{13}$ は水素原子、ハロゲン原子、置換基を有してもよい



【請求項15】 連鎖重合性官能基 $P^1$ 、 $P^2$ の一方又は両方が上記一般式(7)あるいは一般式(8)である請求項14に記載の電子写真感光体。

【請求項16】 重合が電子線により行われる請求項1～15のいずれかに記載の電子写真感光体。

【請求項17】 電子線の加速電圧が250KV以下である請求項16に記載の電子写真感光体。

【請求項18】 電子線の線量が1～100Mradである請求項16又は17に記載の電子写真感光体。

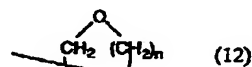
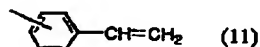
【請求項19】 請求項1～18のいずれかに記載の電子写真感光体を、該電子写真感光体を帯電させる帯電手段、静電潜像の形成された電子写真感光体をトナーで現像する現像手段、及び転写工程後の電子写真感光体上に残余するトナーを回収するクリーニング手段からなる群より選ばれた少なくとも一つの手段と共に一体に支持し、電子写真装置本体に着脱自在であることを特徴とするプロセスカートリッジ。

【請求項20】 請求項1～18のいずれかに記載の電子写真感光体、該電子写真感光体を帯電させる帯電手段、帯電した電子写真感光体に対し露光を行い静電潜像を形成する露光手段、静電潜像の形成された電子写真感光体にトナーで現像する現像手段、及び電子写真感光体

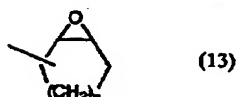
いアルキル基、置換基を有してもよいアルキル基又は置換基を有してもよいアリール基)又は $-\text{CONR}^{14}\text{R}^{15}$  ( $R^{14}$ 及び $R^{15}$ は水素原子、ハロゲン原子、置換基を有してもよいアルキル基、置換基を有してもよいアルキル基又は置換基を有してもよいアリール基を示し、互いに同一であっても異なってもよい)を示し、Wは置換基を有してもよいアリーレン基、置換基を有してもよいアルキレン基、 $-\text{COO}-$ 、 $-\text{CH}_2-$ 、 $-\text{O}-$ 、 $-\text{OO}-$ 、 $-\text{S}-$ 又は $-\text{CONR}^{16}-$  ( $R^{16}$ は水素原子、ハロゲン原子、置換基を有してもよいアルキル基、置換基を有してもよいアルキル基又は置換基を有してもよいアリール基)を示す。fは0又は1を示す。)

【請求項14】 連鎖重合性官能基 $P^1$ 、 $P^2$ の一方又は両方が下記一般式(7)～一般式(13)の何れかである請求項4～12のいずれかに記載の電子写真感光体。

【化7】



(nは1から3の整数)



(nは1から3の整数)

上のトナー像を転写材上に転写する転写手段を備えることを特徴とする電子写真装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、電子写真感光体、プロセスカートリッジ及び電子写真装置に関し、詳しくは、表面層に特定の化合物を含有し、かつ感光層に分子量350以上の電荷輸送材料を含有する電子写真感光体、その電子写真感光体を有するプロセスカートリッジ及び電子写真装置に関する。

【0002】

【従来の技術】従来、電子写真感光体に、セレン、硫化カドミウム及び酸化亜鉛等の無機光導電性材料が広く用いられていた。一方、有機光導電性材料を用いた電子写真感光体としては、ポリ-N-ビニルカリバゾールに代表される光導電性ポリマーや2,5-ビス(p-ジエチルアミノフェニル)-1,3,4-オキサジアゾールのような低分子の有機光導電性材料を用いたもの、更には、かかる有機光導電性材料と各種染料や顔料を組み合わせたもの等が知られている。

【0003】有機光導電性材料を用いた電子写真感光体は成膜性が良く、塗工によって生産できるため、極めて

生産性が高く安価な電子写真感光体を提供できる利点を有している。また、使用する染料や顔料等の選択により、感光波長域を自在にコントロールできる等の利点を有し、これまで幅広い検討がなされてきた。特に最近では、有機光導電性染料や顔料を含有した電荷発生層と光導電性ポリマーや低分子の有機光導電性材料を含有した電荷輸送層を積層した機能分離型の電子写真感光体の開発により、従来の有機電子写真感光体の欠点とされていた感度や耐久性に著しい改善がなされてきており、これが有機電子写真感光体の主流となってきた。

【0004】一方、当然のことながら電子写真感光体には適用される電子写真プロセスに応じた感度、電気的特性、更には光学的特性を備えていることが要求される。特に、繰り返し使用される電子写真感光体においては、その電子写真感光体表面には帯電、画像露光、トナー現象、紙への転写、クリーニング処理といった電気的、機械的外力が直接加えられるため、それらに対する耐久性が要求される。具体的には、摺擦による表面の磨耗や傷の発生に対する耐久性、帯電による表面劣化が挙げられ、より詳しくは転写効率や滑り性の低下、更には感度低下、電位低下等の電気特性の劣化に対する耐久性も要求される。

【0005】一般に電子写真感光体の表面は薄い樹脂層であり、樹脂の特性が非常に重要である。上述の諸条件をある程度満足する樹脂として、近年、アクリル樹脂やポリカーボネート樹脂等が実用化されているが、前述したような特性の全てがこれらの樹脂で満足されるわけではなく、特に電子写真感光体の高耐久化を図る上では該樹脂の被膜硬度は十分高いとは言い難い。これらの樹脂を表面層形成用の樹脂として用いた場合でも繰り返し使用時において表面層の磨耗が起り、更に傷が発生するという問題点があった。

【0006】更に、近年の有機電子写真感光体の高感度化に対する要求から電荷輸送材料等の低分子量化合物が比較的大量に添加される場合が多いが、この場合それら低分子量材料の可塑剤的な作用により膜強度が著しく低下し、一層繰り返し使用時の表面層の磨耗や傷発生が問題となっている。また、電子写真感光体を長期にわたって保存する際に前述の低分子量成分が析出してしまい、層分離するといった問題も発生している。

【0007】これらの問題点を解決する手段として、硬化性の樹脂を電荷輸送層用の樹脂として用いる試みが、例えば特開平2-127652号公報等に開示されている。このように、電荷輸送層用の樹脂に硬化性の樹脂を用い電荷輸送層を硬化、架橋することによって機械的強度が増し、繰り返し使用時の耐削れ性及び耐傷性は大きく向上する。しかしながら硬化性樹脂を用いても、低分子量成分はあくまでも結着樹脂中において可塑剤として作用するので、先に述べたような析出や層分離の問題は根本的な解決にはなっていない。

【0008】また、有機電荷輸送材料と結着樹脂とで構成される電荷輸送層においては、電荷輸送能の樹脂に対する依存度が大きく、例えば硬度が十分に高い硬化性樹脂では電荷輸送能が十分ではなく繰り返し使用時に残留電位の上昇が見られる等、両者を満足させるまでには至っていない。

【0009】また、特開平5-216249号公報、特開平7-72640号公報等においては、電荷移動層に炭素-炭素二重結合を有するモノマーを含有させ、電荷移動材の炭素-炭素二重結合と熱あるいは光のエネルギーによって反応させて電荷移動層硬化膜を形成した電子写真感光体が開示されているが、電荷輸送材はポリマー主骨格にペンダント状に固定化されているだけであり、先の可塑的な作用を十分に排除できないため機械的強度が十分ではない。また、電荷輸送能の向上のために電荷輸送材の濃度を高くすると、架橋密度が低くなり十分な機械的強度を確保することができない。更には、重合時に必要とされる開始剤類の電子写真特性への影響も懸念される。

【0010】また、別の解決手段として例えば特開平8-248649号公報等においては、熱可塑性高分子主鎖中に電荷輸送能を有する基を導入し電荷輸送層を形成させた電子写真感光体が開示されているが、従来の分子分散型の電荷輸送層と比較して析出や層分離に対しては効果があり、機械的強度も向上するが、あくまでも熱可塑性樹脂であり、その機械的強度には限界があり、樹脂の溶解性等を含めたハンドリングや生産性の面で十分であるとは言い難い。

【0011】以上述べたことを背景にして、本発明者らは、高い機械的強度と電荷輸送能の両立を達成するための検討を重ねた。その結果、同一分子内に二つ以上の連鎖重合性官能基を有する正孔輸送性化合物を重合させた化合物を含有した電子写真感光体によって機械的強度と電荷輸送能の両立がほぼ達成されることが確認された。

【0012】しかしながら、これを保護層として用いた場合においては、同一分子内に二つ以上の連鎖重合性官能基を有する正孔輸送性化合物を使用することで機械的強度は向上するが、感光層が有機系感光層である場合において感度が十分に得られなかったり、残留電位の上昇がみられることもあった。また、環境の変化に伴い電位が変動してしまい、安定した電位特性を得られないこともあった。

【0013】近年の高画質化、高耐久化に伴い、より優れた電子写真感光体を提供するためにはこれらの問題をぜひ解決する必要があった。

【0014】

【発明が解決しようとする課題】本発明の目的は、保護層を形成しても感度が良好であり、残留電位の上昇が少なく、環境変化による電位変動が小さく、安定した電子写真特性が得られる電子写真感光体を提供することにある。

る。

【0015】本発明の別の目的は、上記電子写真感光体を有するプロセスカートリッジ及び電子写真装置を提供することにある。

【0016】

【課題を解決するための手段】本発明に従って、導電性支持体、感光層及び保護層を有する電子写真感光体において、該保護層が同一分子内に2つ以上の連鎖重合性官能基を有する正孔輸送性化合物を重合した化合物を含有し、かつ該感光層が分子量350以上の電荷輸送材料を含有することを特徴とする電子写真感光体が提供される。

【0017】また本発明に従って、上記電子写真感光体を有するプロセスカートリッジ及び電子写真装置が提供される。

【0018】

【発明の実施の形態】次に、本発明の電子写真感光体の構成を詳細に説明する。

【0019】まず、本発明における保護層について説明する。はじめに、連鎖重合性官能基を有する正孔輸送性化合物について説明する。

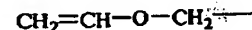
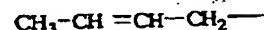
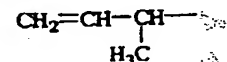
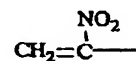
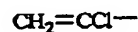
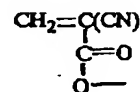
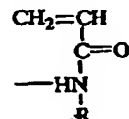
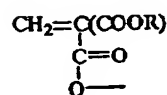
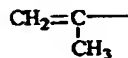
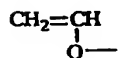
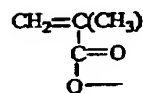
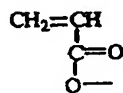
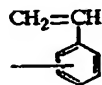
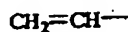
【0020】本発明における連鎖重合とは、高分子物の生成反応を大きく連鎖重合と逐次重合に分けた場合の前者の重合反応形態を示し、詳しくは例えば技報堂出版三羽忠広著の「基礎 合成樹脂の化学（新版）」1995年7月25日（1版8刷）P. 24に説明されているように、その形態が主にラジカルあるいはイオン等の中間体を經由して反応が進行する不飽和重合、開環重合そして異性化重合等のことをいう。前記一般式（1）における連鎖重合性官能基 $P^1$ 及び $P^2$ とは、前述の反応形態が可能な官能基を意味するが、ここではその大半を占め応用範囲の広い不飽和重合あるいは開環重合性官能基の具体例を示す。

【0021】不飽和重合とは、ラジカル、イオン等によって不飽和基、例えば $C=C$ 、 $C\equiv C$ 、 $C=O$ 、 $C=N$ 、 $C\equiv N$ 等が重合する反応であるが、主には $C=C$ である。不飽和重合性官能基の具体例を表1に示すがこれらに限定されるものではない。

【0022】

【表1】

表1：不飽和重合性官能基の具体例



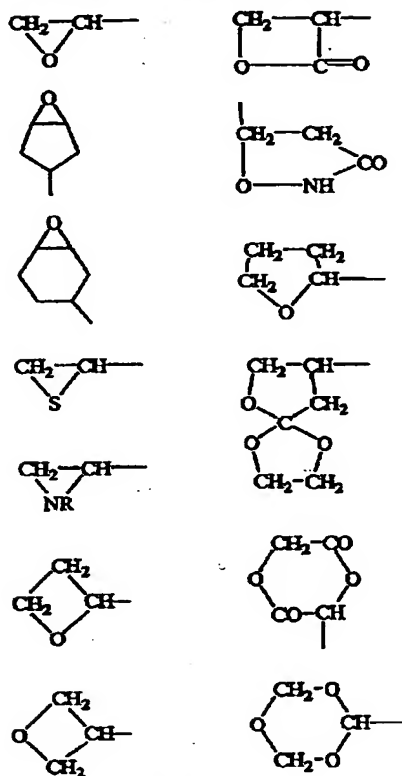
【0023】表中、Rは置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアリール基、置換基を有してもよいフェニル基、ナフチル基及びアンスリル基等のアリール基又は水素原子を示す。

【0024】開環重合とは、炭素環、オクソ環及び窒素ヘテロ環等のひずみを有した不安定な環状構造が触媒の作用で活性化され、開環すると同時に重合を繰り返して鎖状高分子物を生成する反応であるが、この場合、基本的にはイオンが活性種として作用するものが大部分である。開環重合性官能基の具体例を表2に示すがこれらに限定されるものではない。

【0025】

【表2】

表2. 開環重合性官能基の具体例

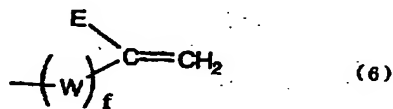


【0026】表中、Rは置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基、置換基を有してもよいフェニル基、ナフチル基及びアンズリル基等のアリール基又は水素原子を示す。

【0027】上記で説明したような本発明に係わる連鎖重合性官能基の中でも、下記的一般式(6)、(14)及び(15)で示されるものが好ましい。

【0028】

【化8】



【0029】式中、Eは水素原子、フッ素、塩素及び臭素等のハロゲン原子、置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基、置換基を有してもよいフェニル基、ナフチル基、アンズリル基、ビレニル基、チオフェニル基及びフリル基等のアリール基、メトキシ基、エトキシ基及びプロポ

キシ基等のアルコキシ基、CN基、ニトロ基、 $-\text{COO}$   $\text{R}^{13}$ 又は $-\text{CONR}^{14}\text{R}^{15}$ を示す。

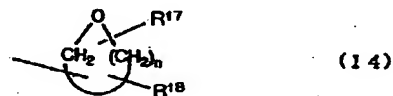
【0030】Wは置換基を有してもよいフェニレン基、ナフチレン基及びアントラセニレン基等のアリーレン基、置換基を有してもよいメチレン基、エチレン基及びブチレン等のアルキレン基、 $-\text{COO}-$ 、 $-\text{CH}_2-$ 、 $-\text{O}-$ 、 $-\text{OO}-$ 、 $-\text{S}-$ 又は $-\text{CONR}^{16}-$ で示される。

【0031】 $\text{R}^{13}$ 、 $\text{R}^{14}$ 、 $\text{R}^{15}$ 及び $\text{R}^{16}$ は水素原子、フッ素、塩素、臭素及びヨウ素等のハロゲン原子、置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいベンジル基及びフェネチル基等のアラルキル基又は置換基を有してもよいフェニル基、ナフチル基及びアンズリル基等のアリール基を示し、 $\text{R}^{14}$ と $\text{R}^{15}$ は互いに同一であっても異なってもよい。また、fは0又は1を示す。

【0032】E及びW中で有してもよい置換基としては、フッ素、塩素、臭素及びヨウ素等のハロゲン原子；ニトロ基、シアノ基、水酸基；メチル基、エチル基、プロピル基及びブチル基等のアルキル基；メトキシ基、エトキシ基及びプロポキシ基等のアルコキシ基；フェノキシ基及びナフトキシ基等のアリールオキシ基；ベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基；又はフェニル基、ナフチル基、アンズリル基及びビレニル基等のアリール基等が挙げられる。

【0033】

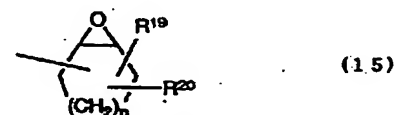
【化9】



【0034】式中、 $\text{R}^{17}$ 及び $\text{R}^{18}$ は水素原子、置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいベンジル基及びフェネチル基等のアラルキル基、又は置換基を有してもよいフェニル基及びナフチル基等のアリール基を示し、nは1~10の整数を示す。

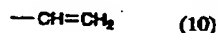
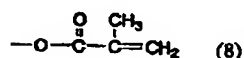
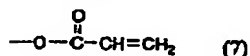
【0035】

【化10】



式中、 $\text{R}^{19}$ 及び $\text{R}^{20}$ は水素原子、置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいベンジル基及びフェネチル基等のアラルキル基、又は置換基を有してもよいフェニル基及びナフチル基等のアリール基を示し、nは0~10の整数を示す。

【0036】なお、上記一般式(14)及び(15)の $R^{17}$ 、 $R^{18}$ 、 $R^{19}$ 及び $R^{20}$ が有してもよい置換基としてはフッ素、塩素、臭素及びヨウ素等のハロゲン原子；メチル基、エチル基、プロピル基及びブチル基等のアルキル基；メトキシ基、エトキシ基及びプロポキシ基等のアルコキシ基；フェノキシ基及びナフトキシ基等のアリールオキシ基；ベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル



【0039】更に、上記一般式(7)～一般式(13)の中でも、一般式(7)のアクリロイルオキシ基及び一般式(8)のメタクリロイルオキシ基が、重合特性等の点から特に一番好ましい。

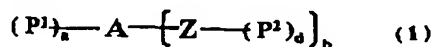
【0040】次に、本発明における正孔輸送性材料について説明する。

【0041】本発明で『連鎖重合性官能基を有する正孔輸送性化合物』とは、上記で説明した連鎖重合性官能基が下記で説明する正孔輸送性化合物に官能基として好ましくは2つ以上の化学結合している化合物を示す。この場合、それらの連鎖重合性官能基は、全て同一でも異なったものであってもよい。

【0042】それらの連鎖重合性官能基を2つ以上有する正孔輸送性化合物としては、下記一般式(1)である場合が好ましい。

【0043】

【化12】



【0044】式中、Aは正孔輸送性基を示す。 $P^1$ 及び $P^2$ は連鎖重合性官能基を示す。 $P^1$ と $P^2$ は同一でも異なってもよい。Zは置換基を有してもよい有機基を示す。a、b及びdは0以上の整数を示し、 $a+b \times d$ は2以上の整数を示す。また、aが2以上の場合 $P^1$ は同一でも異なってもよく、dが2以上の場合、Z及び $P^2$ は同一でも異なってもよい。

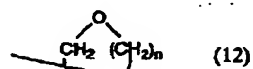
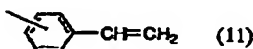
【0045】なおここで、『aが2以上の場合 $P^1$ は同一でも異なってもよく』とは、それぞれ異なるn種類の連鎖重合性官能基を $P^{11}$ 、 $P^{12}$ 、 $P^{13}$ 、 $P^{14}$ 、 $P^{15}$ ... $P^{1n}$ と示した場合、例えばa=3のとき正孔輸送性

基；又はフェニル基、ナフチル基、アンスリル基及びビレニル基等のアリール基等が挙げられる。

【0037】また、上記一般式(6)、(14)及び(15)の中でも、更に好ましい連鎖重合性官能基としては、下記一般式(7)～一般式(13)で示されるものが挙げられる。

【0038】

【化11】



(nは1から3の整数)



(nは1から3の整数)

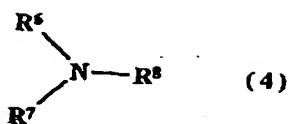
化合物Aに直接結合する重合性官能基 $P^1$ は3つとも同じものでも、2つ同じで1つは違うもの(例えば、 $P^{11}$ と $P^{11}$ と $P^{12}$ とか)でも、それぞれ3つとも異なるもの(例えば、 $P^{12}$ と $P^{15}$ と $P^{17}$ とか)でも良いということを意味するものである(『dが2以上の場合 $P^2$ は同一でも異なってもよく』というのも、『bが2以上の場合、Z及び $P^2$ は同一でも異なってもよい』というのもこれと同様なことを意味するものである)。

【0046】上記一般式(1)のAと $P^1$ やZとの結合部位を水素原子に置き換えた正孔輸送化合物は、例えば、オキサゾール誘導体、オキサジアゾール誘導体、イミダゾール誘導体、トリフェニルアミン等のトリアリールアミン誘導体、9-(p-ジエチルアミノステリル)アントラセン、1,1-ビス-(4-ジベンジルアミノフェニル)プロパン、スチリルアントラセン、スチリルピラゾリン、フェニルヒドラゾン類、チアゾール誘導体、トリアゾール誘導体、フェナジン誘導体、アクリジン誘導体、ベンゾフラン誘導体、ベンズイミダゾール誘導体、チオフェン誘導体及びN-フェニルカルバゾール誘導体等が挙げられる。

【0047】更に、上記正孔輸送化合物の中でも、下記一般式(4)、(5)、(16)、(17)及び(19)から選ばれる式で示される化合物、あるいは下記一般式(18)で示される基を有する縮合環炭化水素又は下記一般式(18)で示される基を有する縮合複素環であるものが好ましい。更に、その中でも、一般式(4)及び(5)で示される化合物である場合が特に好ましい。

【0048】

【化13】

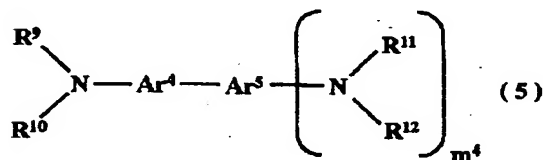


【0049】上記一般式(4)中、 $R^6$ 、 $R^7$ 及び $R^8$ は置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等の炭素数10以下のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基又は置換基を有してもよいフェニル基、ナフチル基、アンスリル基、フェナンスリル基、ビレニル基、チオフェニル基、フリル基、ビリジル基、キノリル基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフェニル基、ジベンゾフリル基及びジベンゾチオフェニル基等のアリール基を示す。

【0050】但し、 $R^6$ 、 $R^7$ 及び $R^8$ のうち少なくとも2つはアリール基を示し、 $R^6$ 、 $R^7$ 及び $R^8$ はそれぞれ同一であっても異なってもよい。更に、その中でも $R^6$ 、 $R^7$ 及び $R^8$ の全てがアリール基であるものが特に好ましい。また、上記一般式(4)の $R^6$ 又は $R^7$ 又は $R^8$ のうち任意の2つはそれぞれ直接もしくは結合基を介して結合しても良く、その結合基としては、メチレン基、エチレン基及びプロピレン基等のアルキレン基、酸素原子及び硫黄原子等のヘテロ原子又は $CH=CH$ 基等が挙げられる。

【0051】

【化14】



【0052】上記一般式(5)中、 $m^4$ は0又は1を示し、 $m^4=1$ である場合が好ましい。 $R^9 \sim R^{12}$ は置換基を有してもよいメチル基、エチル基、プロピル基及びブ

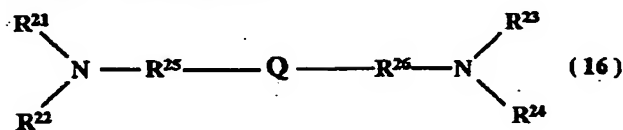
チル基等の炭素数10以下のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基又は置換基を有してもよいフェニル基、ナフチル基、アンスリル基、フェナンスリル基、ビレニル基、チオフェニル基、フリル基、ビリジル基、キノリル基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフェニル基、ジベンゾフリル基及びジベンゾチオフェニル基等のアリール基を示し、 $R^9 \sim R^{12}$ はそれぞれ同一でも異なってもよい。

【0053】 $Ar^4$ は置換基を有しても良いアリーレン基(ベンゼン、ナフタレン、アントラセン、フェナンスレン、ビレン、チオフェン、フラン、ビリジン、キノリン、ベンゾキノリン、カルバゾール、フェノチアジン、ベンゾフラン、ベンゾチオフェン、ジベンゾフラン、ジベンゾチオフェン等より2個の水素原子を取り除いた基)を示し、 $Ar^5$ は $m^4=0$ の場合、フェニル基、ナフチル基、アンスリル基、フェナンスリル基、ビレニル基、チオフェニル基、フリル基、ビリジル基、キノリル基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフェニル基、ジベンゾフリル基及びジベンゾチオフェニル基等のアリール基を示し、 $m^4=1$ の場合は上記 $Ar^1$ と同様なアリーレン基を示す。なお、 $m^4=1$ の場合は、 $Ar^4$ と $Ar^5$ は同一であっても異なっても良い。

【0054】更にその中でも、上記一般式(5)中の $R^9 \sim R^{12}$ が4つとも全てアリール基である場合が特に好ましい。また、上記一般式(5)の $R^9$ と $R^{10}$ 又は $R^{11}$ と $R^{12}$ 又は $Ar^4$ と $Ar^5$ は、それぞれ直接もしくは結合基を介して結合しても良く、その結合基としては、メチレン基、エチレン基及びプロピレン基等のアルキレン基、カルボニル基、酸素原子及び硫黄原子等のヘテロ原子又は $CH=CH$ 基等が挙げられるが、これらの中ではアルキレン基が好ましい。

【0055】

【化15】



【0056】上記一般式(16)中、 $R^{21}$ 、 $R^{22}$ 、 $R^{23}$ 及び $R^{24}$ は置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等の炭素数10以下のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基又は置換基を有してもよいフェニル基、ナフチル基、アンスリル基、フェナンスリル基、ビレニル基、チオフェニル基、フリル基、ビリジル基、キノリル

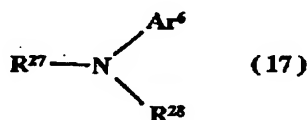
基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフェニル基、ジベンゾフリル基及びジベンゾチオフェニル基等のアリール基を示し、 $R^{21}$ 、 $R^{22}$ 、 $R^{23}$ 及び $R^{24}$ はそれぞれ同一でも異なってもよい。 $R^{25}$ 及び $R^{26}$ は置換基を有してもよいメチレン基、エチレン基及びプロピレン基等の炭素数10以下のアルキレン基、又は置換基を有してもよいアリーレン基(ベンゼン、ナフタレン、アントラセ

ン、フェナンスレン、ビレン、チオフエン、フラン、ビリジン、キノリン、ベンゾキノリン、カルバゾール、フェノチアジン、ベンゾフラン、ベンゾチオフエン、ジベンゾフラン、ジベンゾチオフエン等より2個の水素原子を取り除いた基)を示し、 $R^{25}$ 及び $R^{26}$ は同一であっても異なっても良い。Qは置換基を有しても良い有機基を示す。

【0057】更にその中でも、上記一般式(16)中の $R^{21}$ 、 $R^{22}$ 、 $R^{23}$ 及び $R^{24}$ のうち少なくとも2つが置換基を有しても良いアリール基であり、かつ $R^{25}$ 及び $R^{26}$ が置換基を有しても良いアリーレン基である場合が好ましく、更に $R^{21}$ 、 $R^{22}$ 、 $R^{23}$ 及び $R^{24}$ が4つとも全て置換基を有しても良いアリール基である場合が特に好ましい。また、上記一般式(16)の $R^{21}$ 、 $R^{22}$ 及び $R^{25}$ のうち任意の2つあるいは $R^{23}$ 、 $R^{24}$ 及び $R^{26}$ のうち任意の2つはそれぞれ直接もしくは結合基を介して結合しても良く、その結合基としては、メチレン基、エチレン基及びプロピレン基等のアルキレン基、酸素原子及び硫黄原子等のヘテロ原子又は $CH=CH$ 基等が挙げられる。

【0058】

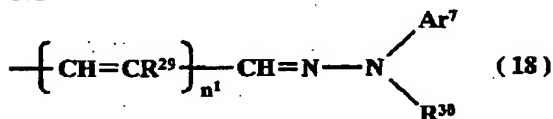
【化16】



【0059】但し上記一般式(17)中、 $R^{27}$ 、 $R^{28}$ 及び $Ar^6$ のうち少なくとも一つは、下記一般式(18)で示される基を少なくとも一つ有する。

【0060】

【化17】



【0061】上記一般式(17)及び(18)中、 $Ar^6$ 及び $Ar^7$ は置換基を有してもよいフェニル基、ナフチル基、アンズリル基、フェナンスリル基、ビレニル基、チオフエニル基、フリル基、ビリジル基、キノリル基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフエニル基、ジベンゾフリル基及びジベンゾチオフエニル基等のアリール基を示し、 $R^{27}$ 、 $R^{28}$ 、 $R^{29}$ 及び $R^{30}$ は置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等の炭素数10以下のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基、置換基を有してもよいフェニル基、ナフチル基、アンズリル基、フェナンスリル基、ビレニル基、チオフエニル基、フリル基、ビ

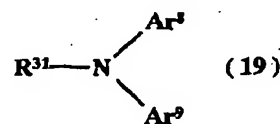
リジル基、キノリル基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフエニル基、ジベンゾフリル基及びジベンゾチオフエニル基等のアリール基を示し、 $R^{29}$ 及び $R^{30}$ はこれらのアルキル基、アラルキル基及びアリール基に加え水素原子を示す。更に、 $R^{27}$ と $R^{28}$ 及び $R^{29}$ と $R^{30}$ はそれぞれ同一であっても異なってもよい。

【0062】また、 $R^{27}$ 又は $R^{28}$ 又は $Ar^6$ のうち任意の2つ、又は $Ar^7$ 及び $R^{30}$ はそれぞれ直接もしくは結合基を介して結合しても良く、その結合基としては、メチレン基、エチレン基及びプロピレン基等のアルキレン基、酸素原子及び硫黄原子等のヘテロ原子又は $CH=CH$ 基等が挙げられる。 $n^1$ は0~2の整数を示す。なお、その中でも $R^{30}$ がアリール基である場合が好ましく、更に $R^{27}$ と $R^{28}$ がアリール基である場合が特に好ましい。

【0063】更に、上記一般式(18)で示される基を有する化合物としては、置換基を有してもよい、ナフタレン基、アントラセン基、フェナンスレン基、ペレン基、フルオレン基、フルオランセン基、アズレン基、インデン基、ペリレン基、クリセン基及びコロネン基等の縮合環炭化水素又は置換基を有してもよいベンゾフラン基、インドール基、カルバゾール基、ベンズカルバゾール基、アクリジン基、フェノチアジン基及びキノリン基等の縮合複素環が挙げられる。

【0064】

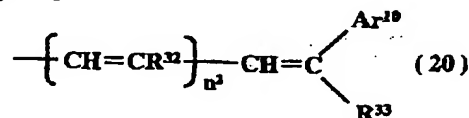
【化18】



【0065】但し、上記一般式(19)は、下記一般式(20)で示される基を少なくとも一つ有する。

【0066】

【化19】



【0067】上記一般式(19)及び(20)中、 $Ar^8$ 、 $Ar^9$ 及び $Ar^{10}$ は置換基を有してもよいフェニル基、ナフチル基、アンズリル基、フェナンスリル基、ビレニル基、チオフエニル基、フリル基、ビリジル基、キノリル基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフエニル基、ジベンゾフリル基及びジベンゾチオフエニル基等のアリール基を示し、 $R^{31}$ 、 $R^{32}$ 及び $R^{33}$ は置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基



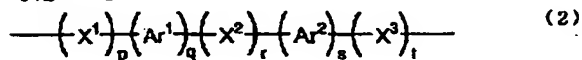
等の炭素数10以下のアルキル基、置換基を有してもよいベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基、置換基を有してもよいフェニル基、ナフチル基、アンスリル基、フェナシスリル基、ピレニル基、チオフェニル基、フリル基、ピリジル基、キノリル基、ベンゾキノリル基、カルバゾリル基、フェノチアジニル基、ベンゾフリル基、ベンゾチオフェニル基、ジベンゾフリル基及びジベンゾチオフェニル基等のアリール基を示し、 $R^{32}$ 及び $R^{33}$ はこれらのアルキル基、アラルキル基及びアリール基に加え水素原子を示す。なお、 $Ar^8$ 及び $Ar^9$ と $R^{32}$ と $R^{33}$ はそれぞれ同一であっても異なってもよい。

【0068】その中でも、 $R^{31}$ 及び $R^{32}$ がアリール基である場合が好ましい。また、 $R^{31}$ 、 $Ar^8$ 又は $Ar^9$ のうち任意の2つ、又は $Ar^{10}$ 及び $R^{33}$ はそれぞれ直接もしくは結合基を介して結合しても良く、その結合基としては、メチレン基、エチレン基及びプロピレン基等のアルキレン基、酸素原子及び硫黄原子等のヘテロ原子又は $C=CH$ 基等が挙げられる。 $n^2$ は0~2の整数を示す。

【0069】また、上記一般式(1)中のZ及び上記一般式(16)中のQは置換基を有してもよいアルキレン基、置換基を有してもよいアリーレン基、 $CR^1=CR^2$  ( $R^1$ 及び $R^2$ はアルキル基、アリール基又は水素原子を示し、 $R^1$ 及び $R^2$ は同一でも異なってもよい)、 $C=O$ 、 $S=O$ 、 $SO_2$ 、酸素原子又は硫黄原子より一つあるいは任意に組み合わされた有機基を示す。その中でも下記一般式(2)で示されるものが好ましく、下記一般式(3)で示されるものが特に好ましい。

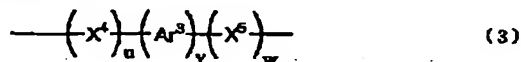
【0070】

【化20】



【0071】

【化21】



【0072】上記一般式(2)中、 $X^1 \sim X^3$ は置換基を有してもよいメチレン基、エチレン基及びプロピレン基等の炭素数20以下のアルキレン基、( $CR^3=CR^4$ )<sub>a1</sub>、 $C=O$ 、 $S=O$ 、 $SO_2$ 、酸素原子又は硫黄原子を示し、 $Ar^1$ 及び $Ar^2$ は置換基を有してもよいアリーレン基(ベンゼン、ナフタレン、アントラセン、フェナンスレン、ピレン、チオフェン、フラン、ピリジン、キノリン、ベンゾキノリン、カルバゾール、フェノチアジン、ベンゾフラン、ベンゾチオフェン、ジベンゾフラン、ジベンゾチオフェン等より2個の水素原子を取り除いた基)を示す。 $R^3$ 及び $R^4$ は置換基を有してもよいメ

チル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいフェニル基、ナフチル基及びチオフェニル基等のアリール基又は水素原子を示し、 $R^3$ 及び $R^4$ は同一でも異なってもよい。 $m^1$ は1~5の整数、 $p \sim t$ は0~10の整数を示す(但し、 $p \sim t$ は同時に0であることはない)。

【0073】上記一般式(3)中、 $X^4$ 及び $X^5$ は( $CH_2$ )<sub>a2</sub>、( $CH=CR^5$ )<sub>a3</sub>、 $C=O$ 、又は酸素原子を示し、 $Ar^3$ は置換基を有してもよいアリーレン基(ベンゼン、ナフタレン、アントラセン、フェナンスレン、ピレン、チオフェン、フラン、ピリジン、キノリン、ベンゾキノリン、カルバゾール、フェノチアジン、ベンゾフラン、ベンゾチオフェン、ジベンゾフラン、ジベンゾチオフェン等より2個の水素原子を取り除いた基)を示す。 $R^5$ は置換基を有してもよいメチル基、エチル基、プロピル基及びブチル基等のアルキル基、置換基を有してもよいフェニル基、ナフチル基及びチオフェニル基等のアリール基又は水素原子を示す。 $m^2$ は1~10の整数、 $m^3$ は1~5の整数、 $u \sim w$ は0~10の整数を示す(特に、0~5の整数の時に特に好ましい。但し、 $u \sim w$ は同時に0であることはない)。

【0074】なお、上述の一般式(1)~(3)、

(5)、(6)及び(14)~(20)の $R^1 \sim R^5$ 、 $R^9 \sim R^{33}$ 、 $Ar^1 \sim Ar^{10}$ 、 $X^1 \sim X^5$ 、Z及びQがそれぞれ有してもよい置換基としてはフッ素、塩素、臭素及びヨウ素等のハロゲン原子；ニトロ基、シアノ基、水酸基；メチル基、エチル基、プロピル基及びブチル基等のアルキル基；メトキシ基、エトキシ基及びプロポキシ基等のアルコキシ基；フェノキシ基、ナフトキシ基等のアリールオキシ基；ベンジル基、フェネチル基、ナフチルメチル基、フルフリル基及びチエニル基等のアラルキル基；フェニル基、ナフチル基、アンスリル基及びピレニル基等のアリール基が挙げられる。また、一般式(4)の $R^6 \sim R^8$ が有してもよい置換基としてはアリール基を除いた上記置換基及びジフェニルアミノ基及びジ(p-トリル)アミノ基等のジアリールアミノ基が挙げられる。

【0075】また、本発明における同一分子内に1つ以上の連鎖重合性官能基を有する正孔輸送性化合物は、酸化電位が1.2(V)以下であることが好ましく、特に0.4~1.2(V)であることが好ましい。それは、酸化電位が1.2(V)を超えると電荷発生材料からの電荷(正孔)の注入が起こり難く残留電位の上昇、感度悪化及び繰り返し使用時の電位変動が大きくなる等の問題が生じ易く、また0.4(V)未満では帯電能の低下等の問題の他に、化合物自体が容易に酸化されるために劣化し易く、それに起因した感度悪化、画像ボケ及び繰り返し使用時の電位変動が大きくなる等の問題が生じ易くなるためである。

【0076】なお、ここで述べている酸化電位は、以下



の方法によって測定される。

【0077】(酸化電位の測定法)飽和カロメル電極を参照電極とし、電解液に0.1N(n-Bu)<sub>4</sub>N<sup>+</sup>ClO<sub>4</sub><sup>-</sup>アセトニトリル溶液を用い、ポテンシャルスイープによって作用電極(白金)に印加する電位をスイープし、得られた電流-電位曲線がピークを示したときの電位を酸化電位とした。詳しくは、サンプルを0.1N(n-Bu)<sub>4</sub>N<sup>+</sup>ClO<sub>4</sub><sup>-</sup>アセトニトリル溶液に5~10mmol%程度の濃度になるように溶解する。そしてこのサンプル溶液に作用電極によって電圧を加え、電圧を低電位(0V)から高電位(+1.5V)に直線的に変化させた時の電流変化を測定し、電流-電位曲線を得る。この電流-電位曲線において、電流値がピーク(ピークが複数ある場合には最初のピーク)を示したときのピーク

トップの位置の電位を酸化電位とした。

【0078】また更に、上記連鎖重合性官能基を有する正孔輸送性化合物は、正孔輸送能として $1 \times 10^{-7}$  (cm<sup>2</sup>/V·sec)以上のドリフト移動度を有しているものが好ましい(但し、印加電界:  $5 \times 10^4$  V/cm)。 $1 \times 10^{-7}$  (cm<sup>2</sup>/V·sec)未満では電子写真感光体として露光後現像までに正孔が十分に移動できないため見かけ上感度が低減し、残留電位も高くなってしまう問題が発生する場合がある。

【0079】以下に本発明に係わる、連鎖重合性官能基を有する正孔輸送性化合物の代表例を挙げるがこれらに限定されるものではない。

【0080】

【化22】

No.	化合物例
1	
2	
3	
4	
5	

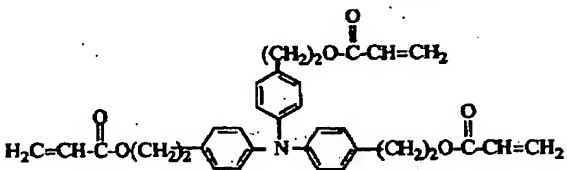
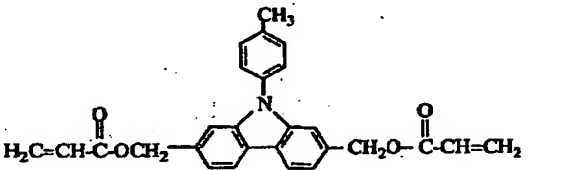
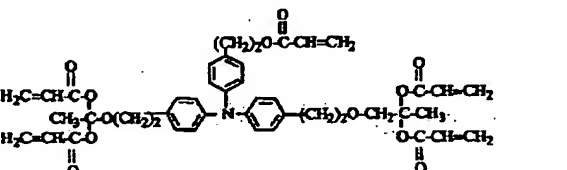
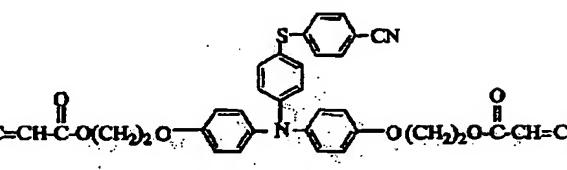
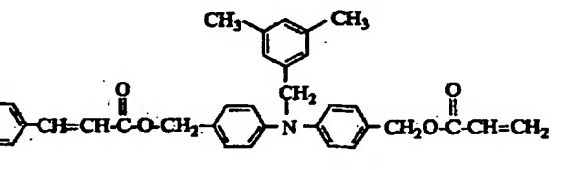
【0081】

【化23】

No.	化合物例
6	$\text{H}_2\text{C}=\text{CH}-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_2-\text{O}-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$
7	$\text{H}_2\text{C}=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_7-\text{O}-\text{C}(=\text{O})-\text{C}(\text{CH}_3)=\text{CH}_2$
8	$\text{H}_2\text{C}=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_2-\text{O}-\text{C}(=\text{O})-\text{C}(\text{CH}_3)=\text{CH}_2$
9	$\text{H}_2\text{C}=\text{CH}-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_2-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{O}(\text{CH}_2)_2-\text{O}-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$
10	$\text{H}_2\text{C}=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_{12}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_{12}-\text{O}-\text{C}(=\text{O})-\text{C}(\text{CH}_3)=\text{CH}_2$

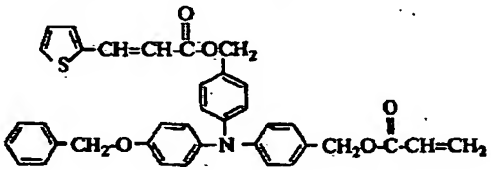
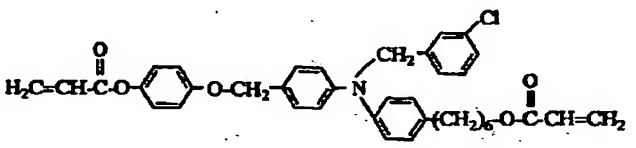
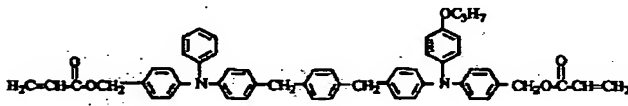
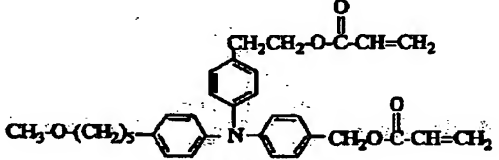
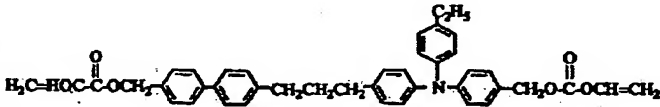
【0082】

【化24】

No.	化 合 物 例
11	
12	
13	
14	
15	

【0083】

【化25】

No.	化 合 物 例
16	
17	
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【0084】

【化26】

No.	化合物例
21	
22	
23	
24	
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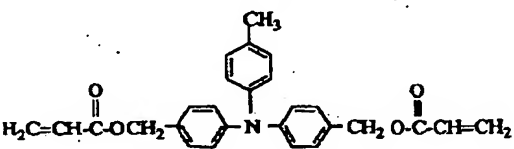
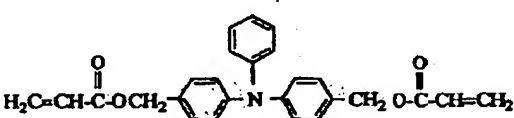
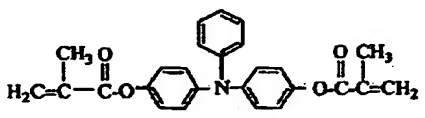
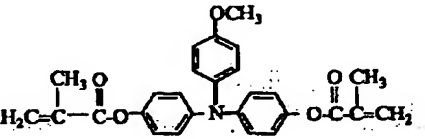
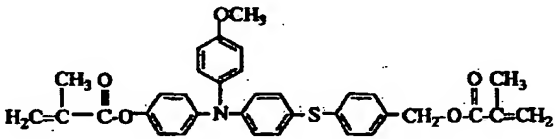
【0085】

【化27】

No.	化 合 物 例
26	
27	
28	
29	
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【0086】

【化28】

No.	化 合 物 例
31	
32	
33	
34	
35	

【0087】

【化29】

No.	化合物例
36	
37	
38	
39	
40	

【0088】

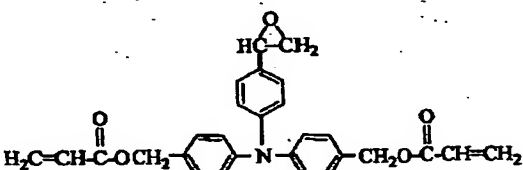
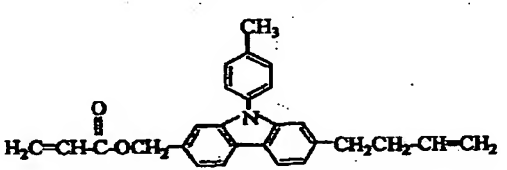
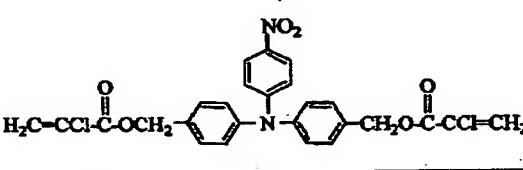
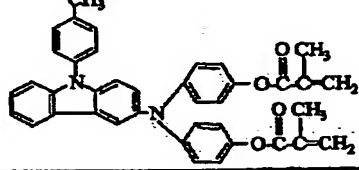
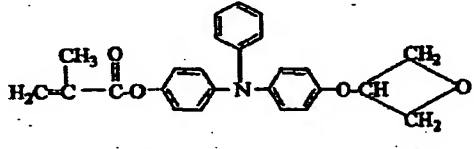
【化30】



No.	化合物例
41	
42	
43	
44	
45	

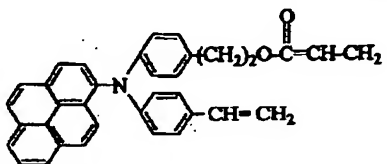
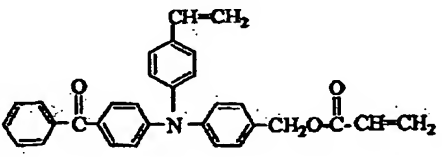
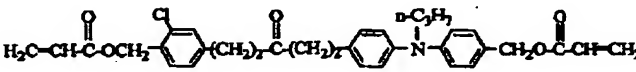
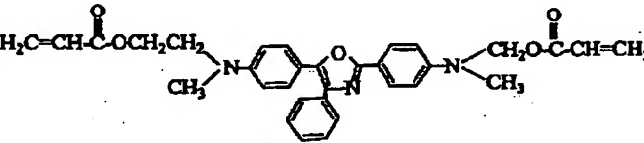
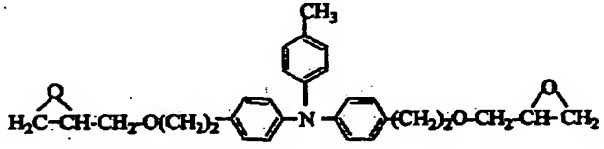
【0089】

【化31】

No.	化合物例
46	
47	
48	
49	
50	

【0090】

【化32】

No.	化合物例
51	
52	
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【0091】

【化33】

No.	化合物例
56	
57	
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59	
60	

【0092】

【化34】

No.	化合物例
71	$\text{H}_2\text{C}=\text{CH}-\text{CH}_2-\text{O}-(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4\text{CH}_3)-\text{C}_6\text{H}_4-(\text{CH}_2)_2-\text{O}-\text{CH}_2-\text{CH}=\text{CH}_2$
72	$\text{H}_2\text{C}-\text{CH}(\text{O})-\text{CH}_2-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{C}_2\text{H}_5)-\text{C}_6\text{H}_4-\text{O}-\text{CH}_2-\text{CH}(\text{O})-\text{CH}_2$
73	$\text{CH}_2-\text{CH}(\text{O})-\text{CH}_2-(\text{CH}_2)_3-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-(\text{CH}_2)_3-\text{CH}(\text{O})-\text{CH}_2$
74	$\text{CH}_2-\text{CH}(\text{O})-\text{CH}_2-(\text{CH}_2)_3-\text{C}_6\text{H}_4-\text{N}(\text{fluorenyl})-\text{C}_6\text{H}_4-(\text{CH}_2)_3-\text{CH}(\text{O})-\text{CH}_2$
75	$\text{CH}_2-\text{CH}(\text{O})-\text{CH}_2-(\text{CH}_2)_3-\text{C}_6\text{H}_4-\text{N}(\text{2,6-dimethylphenyl})-\text{C}_6\text{H}_4-(\text{CH}_2)_3-\text{CH}(\text{O})-\text{CH}_2$

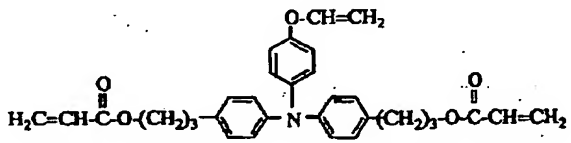
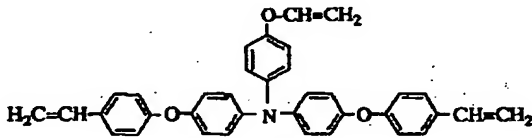
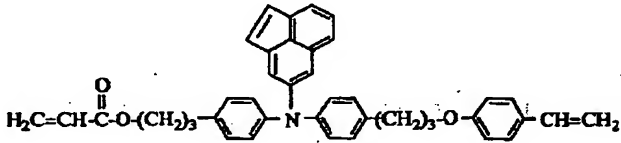
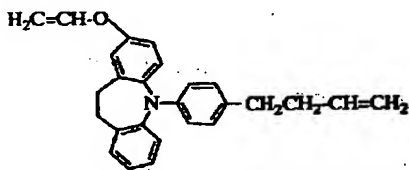
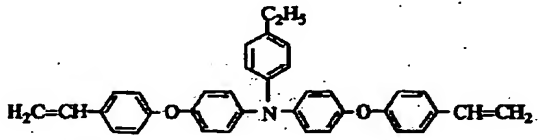
【0095】

【化37】

No.	化合物例
76	
77	
78	
79	
80	

【0096】

【化38】

No.	化合物例
81	
82	
83	
84	
85	

【0097】

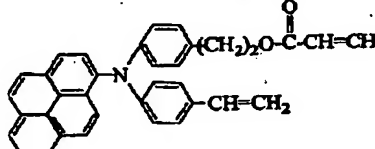
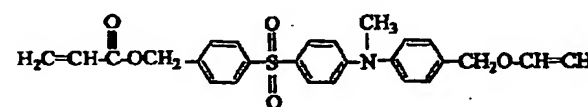
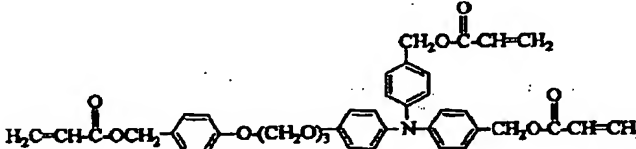
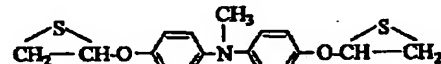
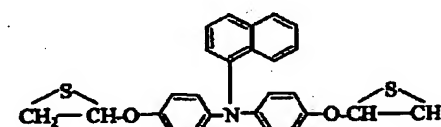
【化39】

No.	化合物例
86	
87	
88	
89	
90	

【0098】

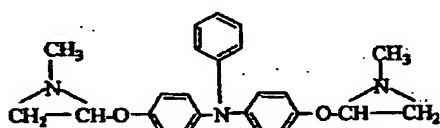
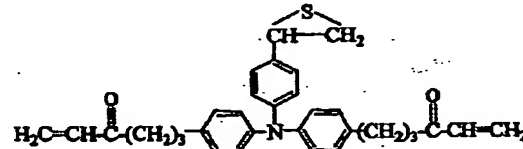
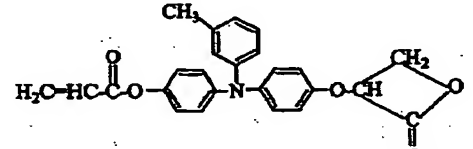
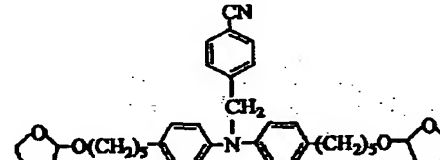
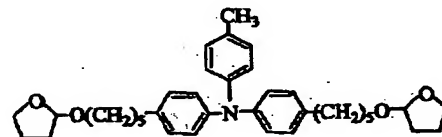
【化40】



No.	化合物例
91	
92	
93	
94	
95	

【0099】

【化41】

No.	化合物例
96	
97	
98	
99	
100	

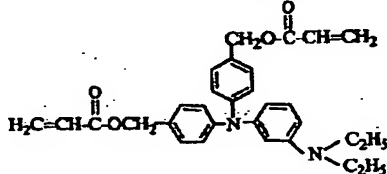
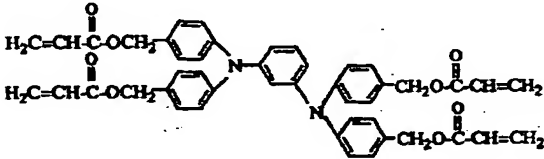
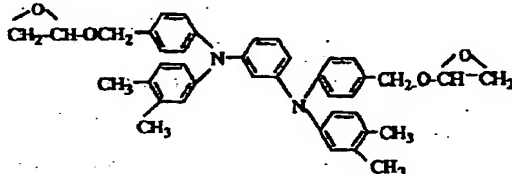
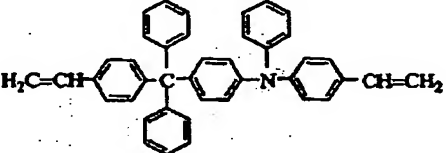
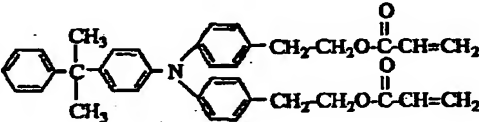
【0100】

【化42】

No.	化合物例
101	<chem>CCOC(=O)c1ccc(cc1)C=C(c2ccc(cc2)C=C(c3ccc(cc3)C(=O)OCC)C(=O)OCC)c4ccc(cc4)C</chem>
102	<chem>CCOC(=O)c1ccc(cc1)C=C(c2ccc(cc2)C=C(c3ccccc3)C(=O)OCC)c4ccc(cc4)C</chem>
103	<chem>CCOC(=O)c1ccc(cc1)C=C(c2ccc(cc2)C=C(c3ccccc3)C(=O)OCC)c4ccc(cc4)C(=O)OCC</chem>
104	<chem>CCOC(=O)c1ccc(cc1)C=C(c2ccc(cc2)C=C(c3ccccc3)C(=O)OCC)c4ccc(cc4)C(=O)OCC</chem>
105	<chem>CCOC(=O)c1ccc(cc1)C=C(c2ccc(cc2)C=C(c3ccccc3)C(=O)OCC)c4ccc(cc4)C(=O)OCC</chem>

【0101】

【化43】

No.	化合物例
106	
107	
108	
109	
110	

【0102】

【化44】

No.	化合物例
111	$\text{H}_2\text{C}=\text{CH}-\text{O}(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_2-\text{O}-\text{CH}=\text{CH}_2$
112	$\text{H}_2\text{C}=\text{CH}-\text{C}_6\text{H}_4-\text{O}(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_2-\text{O}-\text{C}_6\text{H}_4-\text{CH}=\text{CH}_2$
113	$\text{H}_2\text{C}=\text{CH}-\text{C}(=\text{O})\text{OCH}_2-\text{C}_6\text{H}_4-(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{CH}_2-\text{O}-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$
114	$\text{H}_2\text{C}=\text{CH}-\text{C}(=\text{O})\text{OCH}_2-\text{C}_6\text{H}_4-\text{SO}_2-\text{C}_6\text{H}_4-\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{CH}_2-\text{C}_6\text{H}_4-\text{SO}_2-\text{C}_6\text{H}_4-\text{O}-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$
115	$\text{H}_2\text{C}=\text{CH}-\text{C}(=\text{O})\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{CH}-\text{C}(=\text{O})\text{OCH}_2-\text{C}_6\text{H}_4-\text{O}-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$

【0103】

【化45】

No.	化合物例
116	
117	
118	
119	
120	

【0104】

【化46】

No.	化合物例
121	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2-\text{O}-\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{CH}_2-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
122	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2-\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
123	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2-\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
124	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
125	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{C}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$

【0105】

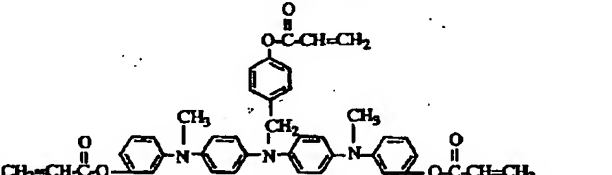
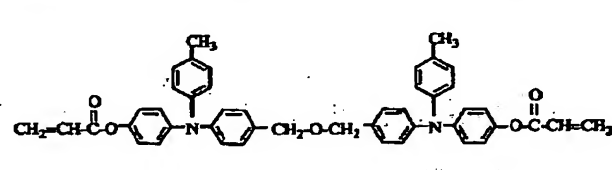
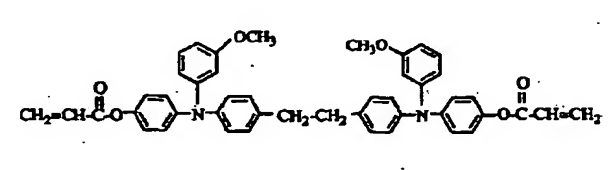
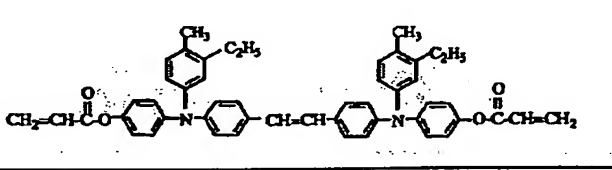
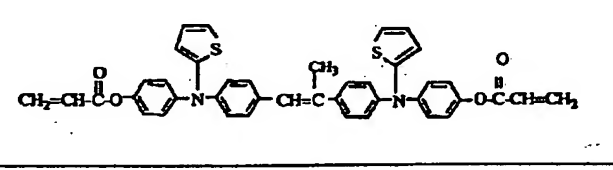
【化47】

No.	化合物例
126	
127	
128	
129	
130	

【0106】

【化48】



No.	化合物例
131	
132	
133	
134	
135	

【0107】

【化49】

No.	化合物例
136	
137	
138	
139	
140	

【0108】

【化50】

No.	化合物例
141	<chem>CCCC(=O)Oc1ccc(cc1)N(c2ccc(cc2)C(C)C)C3=CC=C(C=C3)C(=O)OCC</chem>
142	<chem>CCCC(=O)Oc1ccc(cc1)N(c2ccc(cc2)C(C)C)C3=CC=C(C=C3)OCCCCOc4ccc(cc4)N(c5ccc(cc5)C(C)C)C6=CC=C(C=C6)[N+](=O)[O-]</chem>
143	<chem>CCCC(=O)Oc1ccc(cc1)N(c2ccc(cc2)C(C)C)C3=CC=C(C=C3)C4=CC=C(C=C4)C5=CC=C(C=C5)C6=CC=C(C=C6)N(c7ccc(cc7)C(C)C)C8=CC=C(C=C8)C(=O)OCC</chem>
144	<chem>CCCC(=O)Oc1ccc(cc1)N(c2ccc(cc2)C(C)C)C3=CC=C(C=C3)C4=CC=C(C=C4)C5=CC=C(C=C5)C6=CC=C(C=C6)N(c7ccc(cc7)C(C)C)C8=CC=C(C=C8)C(=O)OCC</chem>
145	<chem>CCCC(=O)Oc1ccc(cc1)N(c2ccc(cc2)C(C)C)C3=CC=C(C=C3)C4=CC=C(C=C4)C5=CC=C(C=C5)C6=CC=C(C=C6)N(c7ccc(cc7)C(C)C)C8=CC=C(C=C8)C(=O)OCC</chem>

【0109】

【化51】

No.	化合物例
146	
147	
148	
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【0110】

【化52】

No.	化合物例
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【0111】

【化53】

No.	化合物例
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【0112】

【化54】

No.	化 合 物 例
161	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
162	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_2\text{C}_6\text{H}_5)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_2\text{C}_6\text{H}_5)-\text{C}_6\text{H}_4-\text{CH}_2\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
163	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
164	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4\text{CH}_3)-\text{C}_6\text{H}_4-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
165	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4\text{OCH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4\text{OCH}_3)-\text{C}_6\text{H}_4-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$

【0113】

【化55】

No.	化合物例
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【0114】

【化56】



No.	化合物例
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【0115】

【化57】

No.	化合物例
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【0116】

【化58】

No.	化 合 物 例
181	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2-\text{O}-\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
182	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_2\text{C}_6\text{H}_5)-\text{C}_6\text{H}_4-\text{CH}_2-\text{O}-\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_2\text{C}_6\text{H}_5)-\text{C}_6\text{H}_4-\text{CH}_2-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
183	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2-\text{O}-\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}_2-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
184	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2-\text{C}_6\text{H}_3(\text{NO}_2)-\text{CH}_2-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{CH}_2-\text{C}_6\text{H}_3(\text{NO}_2)-\text{CH}_2-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
185	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$

【0117】

【化59】

No.	化合物例
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【0118】

【化60】

No.	化合物例
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【0119】

【化61】

No.	化合物例
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【0120】

【化62】

No.	化合物例
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【0121】

【化63】

No.	化合物例
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【0122】

【化64】



No.	化合物例
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【0123】

【化65】

No.	化合物例
216	<chem>CC1=CC=C(C=C1)N(C2=CC=CC=C2)C3=CC=CC=C3OCCCCCCCCCOc4ccc(cc4)N(C5=CC=CC=C5)C6=CC=C(C=C6)C(=O)CC=CC7=CC=CC=C7</chem>
217	<chem>CC1=CC=C(C=C1)N(C2=CC=CC=C2)C3=CC=CC=C3OCCCC(=O)CCCC(=O)OCC4=CC=C(C=C4)N(C5=CC=CC=C5)C6=CC=C(C=C6)C(=O)CC=CC7=CC=CC=C7</chem>
218	<chem>CCOC1=CC=C(C=C1)N(C2=CC=CC=C2)C3=CC=CC=C3OCCOC(=O)OCC4=CC=C(C=C4)N(C5=CC=CC=C5)C6=CC=C(C=C6)C(=O)CC=CC7=CC=CC=C7</chem>
219	<chem>CC1=CC=C(C=C1)N(C2=CC=CC=C2)C3=CC=C(C=C3)OC(C)C(=O)OC(C)C4=CC=C(C=C4)N(C5=CC=CC=C5)C6=CC=C(C=C6)C(=O)CC=CC7=CC=CC=C7</chem>
220	<chem>CC1=CC=C(C=C1)N(C2=CC=CC=C2)C3=CC=CC=C3OCCc4c5ccccc4c6ccccc56CCOc7ccc(cc7)N(C8=CC=CC=C8)C9=CC=C(C=C9)C(=O)CC=CC10=CC=CC=C10</chem>

【0124】

【化66】

No.	化合物例
221	
222	
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【0125】

【化67】

No.	化 合 物 例
226	
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【0126】

【化68】

No.	化 合 物 例
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【0127】

【化69】

No.	化合物例
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【0128】

【化70】

No.	化合物例
241	<chem>CH2=CH-C(=O)Oc1ccc(NCc2ccccc2)cc1-c3ccc(NCc4ccccc4)cc3OC(=O)C=CH2</chem>
242	<chem>CH2=CH-C(=O)Oc1ccc(NCC)cc1-c3ccc(NC)cc3OC(=O)C=CH2</chem>
243	<chem>CH2=CH-C(=O)CH2Oc1ccc(NC)cc1-c3ccc(NC)cc3OC(=O)C=CH2</chem>
244	<chem>CH2=CH-C(=O)Oc1ccc(NC2=CC=CC=C2OC3CCCCC3)cc1-c3ccc(NC4=CC=CC=C4OC5CCCCC5)cc3OC(=O)C=CH2</chem>
245	<chem>CH2=CH-C(=O)CH2OCH2CH2N(C)Cc1ccc(NCc2ccccc2)cc1-c3ccc(NCc4ccccc4)cc3OC(=O)C=CH2</chem>

【0129】

【化71】

No.	化合物例
246	
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【0130】

【化72】



No.	化 合 物 例
251	
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253	
254	
255	

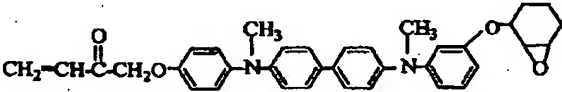
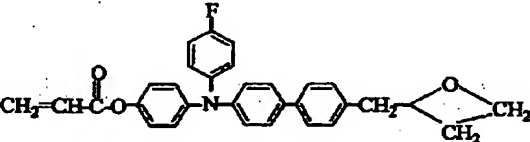
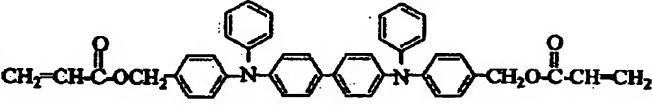
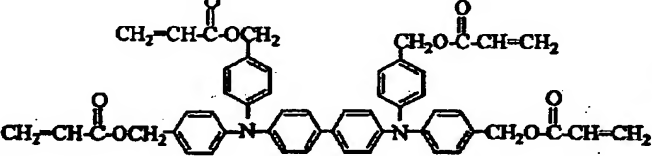
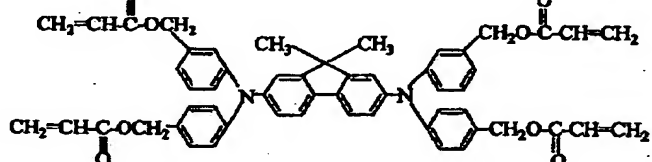
【0131】

【化73】

No.	化合物例
256	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{C}_2\text{H}_5$ $\text{CH}_2=\text{CH}-\text{CH}_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{C}_2\text{H}_5$
257	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{C}_2\text{H}_5$ $\text{CH}_2=\text{CH}-\text{C}_6\text{H}_4-\text{CH}_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{C}_2\text{H}_5$
258	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{C}_2\text{H}_5$ $\text{CH}_2=\text{CH}-\text{CH}_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{C}_2\text{H}_5$
259	$\text{C}_6\text{H}_5-\text{CH}_2-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$ $\text{C}_6\text{H}_5-\text{CH}_2-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)_2-\text{C}_6\text{H}_4-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2$
260	$\text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-\text{C}_6\text{H}_4-\text{N}(\text{C}_2\text{H}_5)-\text{C}_6\text{H}_4-\text{N}(\text{CH}_3)-\text{C}_6\text{H}_4-\text{CH}=\text{CH}_2$

【0132】

【化74】

No.	化合物例
261	
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【0133】

【化75】

No.	化合物例
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【0134】

【化76】

No.	化合物例
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【0135】

【化77】

No.	化合物例
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【0136】

【化78】

No.	化合物例
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【0137】

【化79】

No.	化合物例
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【0138】

【化80】



No.	化合物例
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【0139】

【化81】

No.	化合物例
296	
297	
298	
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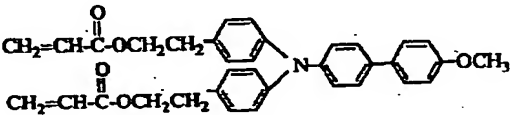
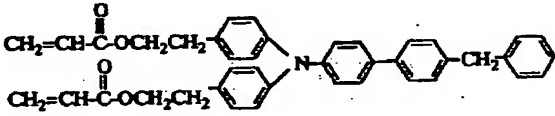
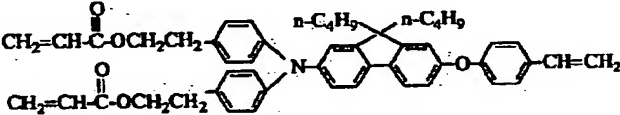
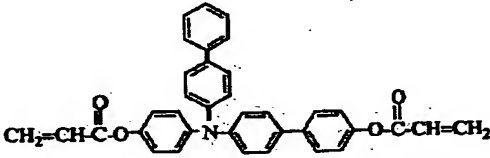
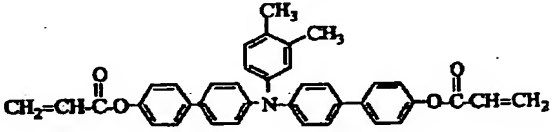
【0140】

【化82】

No.	化 合 物 例
301	
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305	

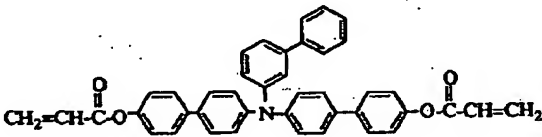
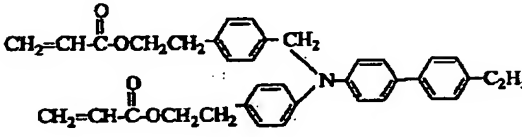
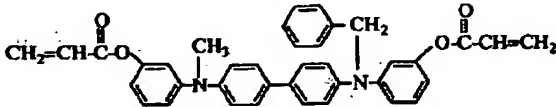
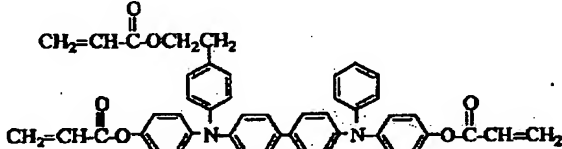
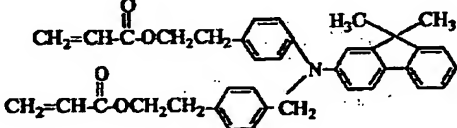
【0141】

【化83】

No.	化合物例
306	 $\begin{array}{l} \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{OCH}_2\text{CH}_2- \\ \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{OCH}_2\text{CH}_2- \end{array}$
307	 $\begin{array}{l} \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{OCH}_2\text{CH}_2- \\ \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{OCH}_2\text{CH}_2- \end{array}$
308	 $\begin{array}{l} \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{OCH}_2\text{CH}_2- \\ \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{OCH}_2\text{CH}_2- \end{array}$
309	 $\begin{array}{l} \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{O}- \\ \text{O}-\text{C}(=\text{O})\text{CH}=\text{CH}_2 \end{array}$
310	 $\begin{array}{l} \text{CH}_2=\text{CH}-\text{C}(=\text{O})\text{O}- \\ \text{O}-\text{C}(=\text{O})\text{CH}=\text{CH}_2 \end{array}$

【0142】

【化84】

No.	化合物例
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【0143】

【化85】

No.	化 合 物 例
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【0144】

【化86】

No.	化合物例
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【0145】

【化87】

No.	化合物例
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【0146】

【化88】



No.	化合物例
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【0147】

【化89】

No.	化合物例
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【0148】

【化90】

No.	化合物例
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【0149】

【化91】

No.	化合物例
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【0150】

【化92】

No.	化合物例
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【0151】

【化93】

No.	化合物例
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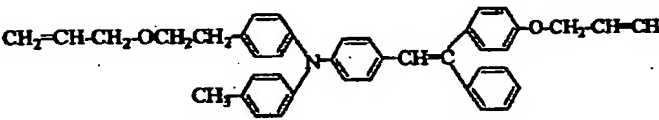
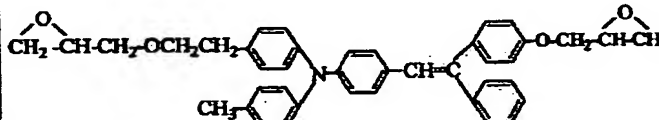
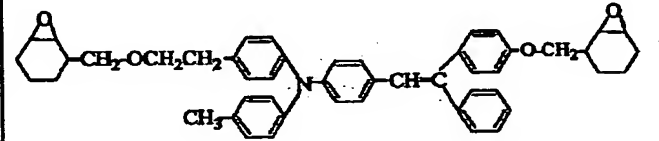
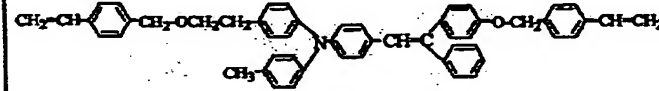
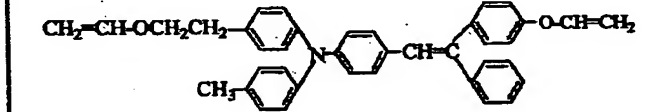
【0152】

【化94】

No.	化合物例
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365	

【0153】

【化95】

No.	化 合 物 例
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【0154】

【化96】



No.	化合物例
371	
372	
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375	

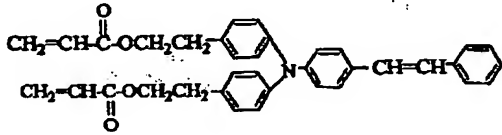
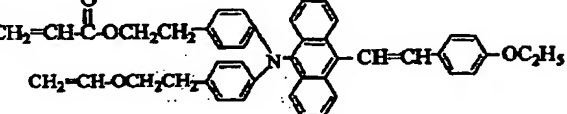
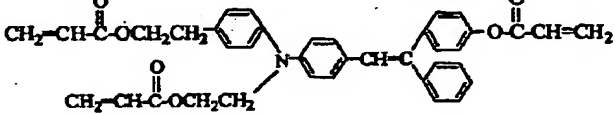
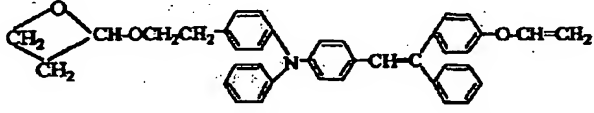
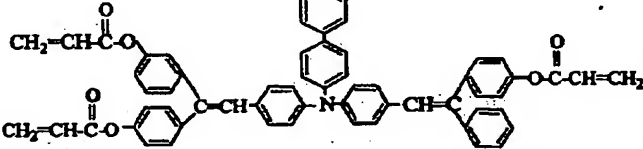
【0155】

【化97】

No.	化 合 物 例
376	
377	
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【0156】

【化98】

No.	化 合 物 例
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【0157】

【化99】

No.	化 合 物 例
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【0158】

【化100】

No.	化合物例
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【0159】

【化101】

No.	化合物例
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397	
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400	

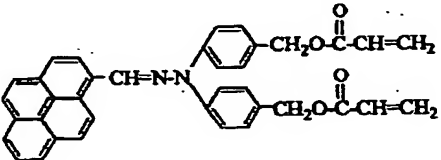
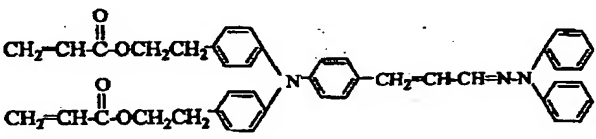
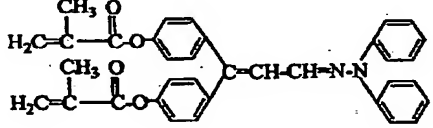
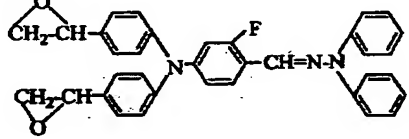
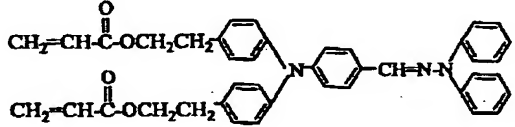
【0160】

【化102】

No.	化合物例
401	
402	
403	
404	
405	

【0161】

【化103】

No.	化合物例
406	
407	
408	
409	
410	

【0162】

【化104】



No.	化合物例
411	<chem>CC(=O)C=COCc1ccc(cc1)N(c2ccc(cc2)C=Cc3ccccc3)c4ccccc4COC(=O)C=C</chem>
412	<chem>CC(=O)C=COCc1ccc(cc1)N(c2ccc(cc2)C=Cc3ccccc3)c4ccccc4COC(=O)C=C</chem>
413	<chem>CC(=O)C=COCc1ccc(cc1)N(c2ccc(cc2)C=Cc3ccccc3)c4ccccc4COC(=O)C=C</chem>
414	<chem>CC(=O)C=COCc1ccc(cc1)N(c2ccc(cc2)C=Cc3ccccc3)c4ccccc4COC(=O)C=C</chem>
415	<chem>CC(=O)C=COCc1ccc(cc1)N(c2ccc(cc2)C=Cc3ccccc3)c4ccccc4COC(=O)C=C</chem>

【0163】

【化105】

No.	化 合 物 例
416	$\begin{array}{c} \text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \\ \text{CH}_2=\text{CH}-\text{CH}_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \end{array}$
417	$\begin{array}{c} \text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \\ \text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \end{array}$
418	$\begin{array}{c} \text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \\ \text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \end{array}$
419	$\begin{array}{c} \text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \\ \text{CH}_2=\text{CH}-\overset{\text{O}}{\parallel}\text{C}-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_4)-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2 \end{array}$
420	$\begin{array}{c} \text{C}_6\text{H}_5-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2 \\ \text{C}_6\text{H}_5-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{CH}=\text{CH}_2 \end{array}$

【0164】

【化106】

No.	化合物例
421	
422	
423	
424	
425	

【0165】

【化107】

No.	化合物例
426	
427	
428	
429	
430	

【0166】

【化108】

No.	化合物例
431	
432	
433	
434	
435	

【0167】

【化109】

No.	化 合 物 例
436	$\text{CH}_2=\text{CH}-\text{CH}_2-\text{OCH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_5)_2-\text{C}_6\text{H}_3(\text{Cl})-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2$
437	$\text{CH}_2=\text{CH}-\text{C}_6\text{H}_4-\text{CH}_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_5)_2-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{CH}=\text{CH}_2$
438	$\text{CH}_2=\text{CH}-\text{CH}_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_5)_2-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2-\text{OCH}_2\text{CH}_2-\text{CH}=\text{CH}_2$
439	$\text{CH}_2=\text{CH}-\text{CH}_2-\text{OCH}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_5)_2-\text{C}_6\text{H}_3(\text{Cl})-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2-\text{OCH}_2\text{CH}=\text{CH}_2$
440	$\text{H}_2\text{C}=\text{CH}-\text{C}(=\text{O})-\text{O}-\text{C}_6\text{H}_4-\text{CH}_2-\text{C}_6\text{H}_4-\text{OOC}-\text{C}_6\text{H}_4-\text{N}(\text{C}_6\text{H}_5)_2-\text{CH}=\text{N}-\text{N}(\text{C}_6\text{H}_5)_2-\text{OOC}-\text{C}_6\text{H}_4-\text{CH}_2-\text{C}_6\text{H}_4-\text{O}-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$

【0168】

【化110】

No.	化合物例
441	
442	

【0169】本発明においては、前記同一分子内に二つ以上の連鎖重合性官能基を有する正孔輸送性化合物を重合することで、保護層において、正孔輸送能を有する化合物は二つ以上の架橋点をもって3次元架橋構造を形成する。前記正孔輸送性化合物はそれのみを重合させる、あるいは他の連鎖重合性官能基を有する化合物と混合させることのいずれもが可能であり、その種類／比率は全て任意である。ここでいう他の連鎖重合性官能基を有する化合物とは、連鎖重合性官能基を有する単量体あるいはオリゴマー／ポリマーのいずれもが含まれる。

【0170】正孔輸送性化合物の官能基とその他の連鎖重合性化合物の官能基が同一の基あるいは互いに重合可能な基である場合には、両者は共有結合を介した共重合3次元架橋構造をとることが可能である。両者の官能基が互いに重合しない官能基である場合には、保護層は二つ以上の3次元硬化物の混合物あるいは主成分の3次元硬化物中に他の連鎖重合性化合物単量体あるいはその硬化物を含んだものとして構成されるが、その配合比率／製膜方法をうまくコントロールすることで、IPN (I

nter Penetrating Network) すなわち相互進入網目構造を形成することも可能である。

【0171】また、前記正孔輸送性化合物と連鎖重合性官能基以外の重合性基を有する単量体あるいはオリゴマー／ポリマー等から保護層を形成してもよい。また、その他の各種添加剤、フッ素原子含有樹脂微粒子等の潤剤その他を含有してもよい。

【0172】本発明において、連鎖重合性官能基を有する正孔輸送性化合物は熱、可視光や紫外線等の光、更に放射線により重合することができる。従って、本発明における保護層の形成は、保護層用の塗工液に前記連鎖重合性官能基を有する正孔輸送性化合物と必要によっては重合開始剤を含有させ、該塗工液を用いて形成した塗工膜に光又は放射線を照射することによって該連鎖重合性官能基を有する正孔輸送性化合物を重合させる。なお、本発明においては、その中でも放射線によって該連鎖重合性官能基を有する正孔輸送性化合物を重合することが好ましい。放射線による重合の最大の利点は、重合開始

剤を必要としない点であり、これにより非常に高純度な3次元保護層の作製が可能となり、良好な耐久性が確保される点である。また、短時間でかつ効率的な重合反応であるがゆえに生産性も高く、更には放射線の透過性の良さから、厚膜時や添加剤等の遮蔽物質が膜中に存在する際の硬化阻害の影響が非常に小さいこと等が挙げられる。但し、連鎖重合性官能基の種類や中心骨格の種類によっては重合反応が進行しにくい場合があり、その際には影響のない範囲内での重合開始剤の添加は可能である。この際、使用する放射線とは電子線及び $\gamma$ 線であるが、特に電子線が好ましい。

【0173】電子線照射をする場合、加速器としてはスキャニング型、エレクトロカーテン型、ブロードビーム型、パルス型及びラミナー型等いずれの形式も使用することができる。電子線を照射する場合に、本発明の電子写真感光体においては電気特性を発現させる上で照射条件が非常に重要である。本発明において、加速電圧は250KV以下が好ましく、最適には150KV以下である。また、線量は好ましくは1Mrad~100Mradの範囲、より好ましくは3Mrad~50Mradの範囲である。加速電圧が250KVを超えると感光体特性に対する電子線照射のダメージが増加する傾向にある。また、照射線量が1Mradよりも少ない場合には硬化が不十分となり易く、線量100Mradより多い場合には感光体特性の劣化が起こり易いので注意が必要である。

【0174】前記正孔輸送性化合物の量は、重合硬化後の保護層膜の全質量に対して、前記一般式(1)で示される連鎖重合性官能基を有する正孔輸送性基Aの水素付加物が20質量%以上が好ましく、特に40質量%以上含有されていることが好ましい。20質量%未満であると電荷輸送能が低下し、感度低下及び残留電位の上昇等の問題点が生じ易い。この場合の保護層としての膜厚は0.1~10 $\mu$ mが好ましく、特に0.5~7 $\mu$ mが好ましい。

【0175】次に、感光層について説明する。

【0176】前述の如く、保護層として同一分子内に2つ以上の連鎖重合性官能基を有する正孔輸送性化合物を使用することで機械的強度は飛躍的に向上するが、感光層が有機系感光層である場合に感度が十分に得られなかったり、残留電位の上昇がみられることもあった。また、環境の変化に伴い電位が変動してしまい、十分に安定した電位特性を得られないこともあった。

【0177】本発明者らは鋭意検討した結果、保護層と接する感光層中の電荷輸送材料の分子量と感度、残電、

及び環境電位変動との間に関係があることを見だし本発明に至った。すなわち、保護層と接する感光層の電荷輸送材料の分子量を350以上にする事で感度の低下、及び残留電位の上昇を抑えることができ、また環境電位変動も抑えることができた。

【0178】本発明のメカニズムは定かではないが以下のように考えられる。保護層として同一分子内に2つ以上の連鎖重合性官能基を有する正孔輸送性化合物を、光及び放射線を照射することによって重合するに際し、保護層下にある感光層にも光及び放射線は到達している。この光及び放射線が、感光層中の電荷発生材料及び電荷輸送材料を劣化させ、感光体特性が低下すると考えられる。分子量の小さい電荷輸送材料は、吸収した光及び放射線エネルギーを分散できず分子の切断による劣化が生じるが、分子量の大きい電荷輸送材料は吸収した光及び放射線エネルギーを非局在化させることができ、熱エネルギーに変換することで安定化が可能になり劣化が抑えられると思われる。また、電荷輸送材料が光及び放射線エネルギーを熱エネルギーに変換させることで、電荷発生材料の劣化も抑えられると思われる。よって、分子量の大きい電荷輸送材料を用いた場合、光及び放射線による電荷発生材料及び電荷輸送材料の劣化を抑制できると考えられる。

【0179】本発明においては、電荷輸送材料の分子量が350以上700以下であることが好ましい。700を超えると溶解性が低下するためか、電位特性及び環境変動が悪化する傾向がみられるからである。

【0180】本発明における感光層が含有する電荷輸送材料は、分子量350以上であればいずれのものでもよい。例えば、ポリ-N-ビニルカルバゾール及びポリスチリルアントラセン等の複素環や縮合多環芳香族を有する高分子化合物や、ピラゾリン、イミダゾール、オキサゾール、トリアゾール及びカルバゾール等の複素環化合物、トリフェニルメタン等のトリアリールアルカン誘導体、トリフェニルアミン等のトリアリールアミン誘導体、フェニレンジアミン誘導体、N-フェニルカルバゾール誘導体、スチルベン誘導体、ヒドラゾン誘導体及びブタジエン誘導体等が挙げられる。

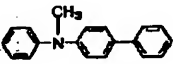
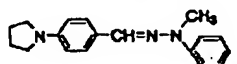
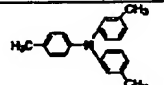
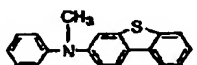
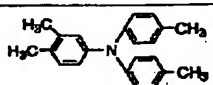
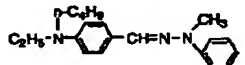
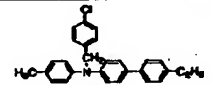
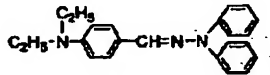
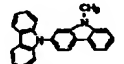
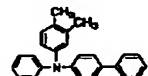
【0181】以下に電荷輸送材料の化合物例とその分子量を示す。化合物例No. 1~No. 11は、分子量350未満なので本発明外の化合物である。もちろん本発明に用いられる電荷輸送材料はこれらに限られるものではない。

【0182】

【化111】



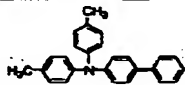
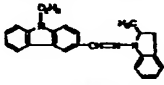
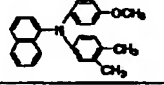
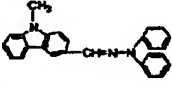
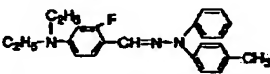
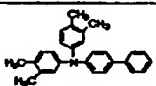
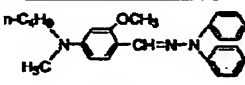
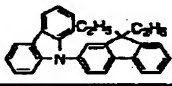
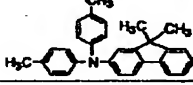
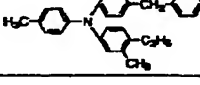
電荷輸送材料の化合物例

No.	化合物例	分子量
1		259.3
2		279.4
3		287.4
4		289.4
5		301.4
6		309.5
7		329.5
8		343.5
9		346.4
10		349.5

【0183】

【化112】

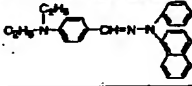
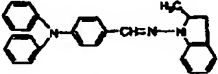
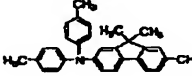
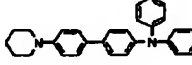
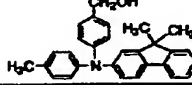
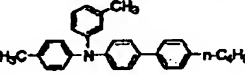
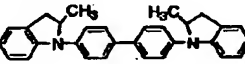
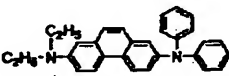
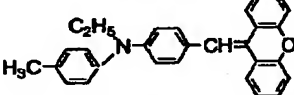
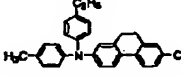
電荷輸送材料の化合物例

No.	化合物例	分子量
11		349.5
12		353.5
13		353.5
14		375.5
15		375.5
16		377.5
17		387.5
18		387.5
19		389.5
20		391.5

【0184】

【化113】

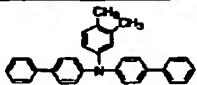
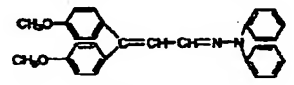
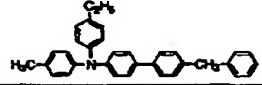
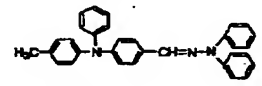
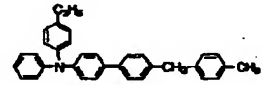
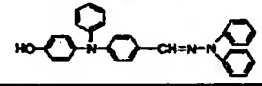
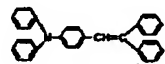
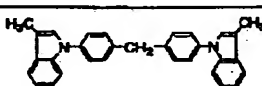
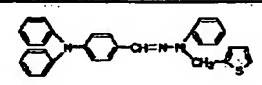
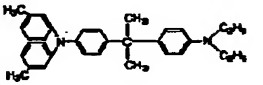
電荷輸送材料の化合物例

No.	化合物例	分子量
21		393.5
22		403.5
23		403.6
24		404.6
25		405.5
26		405.6
27		416.6
28		416.6
29		419.6
30		424.0

【0185】

【化114】

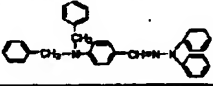
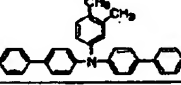
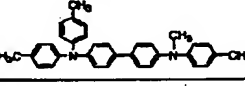
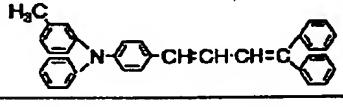
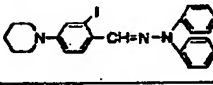
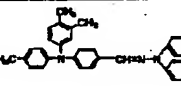
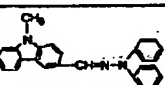
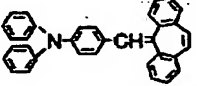
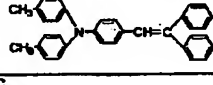
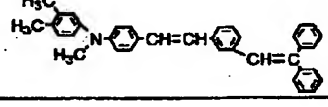
電荷輸送材料の化合物例

No.	化合物例	分子量
31		425.6
32		434.5
33		453.6
34		453.6
35		453.6
36		455.6
37		455.6
38		458.6
39		459.6
40		462.7

【0186】

【化115】

電荷輸送材料の化合物例

No.	化合物例	分子量
41		467.6
42		467.6
43		468.6
44		479.7
45		481.4
46		481.6
47		481.6
48		481.7
49		483.7
50		491.7

【0187】

【化116】

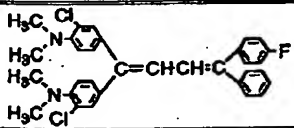
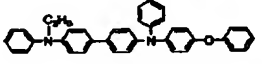
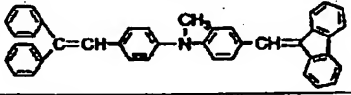
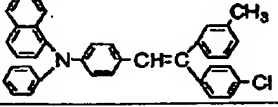
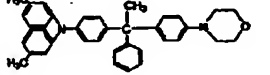
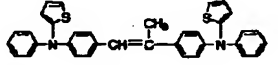
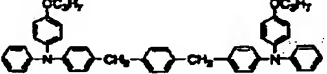
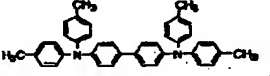
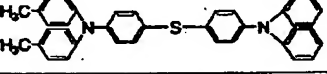
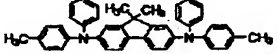
電荷輸送材料の化合物例

No.	化合物例	分子量
51		500.7
52		501.7
53		506.8
54		507.7
55		509.7
56		516.7
57		516.7
58		528.7
59		529.7
60		530.7

【0188】

【化117】

電荷輸送材料の化合物例

No.	化合物例	分子量
61		531.5
62		532.7
63		537.7
64		538.1
65		538.7
66		540.7
67		543.7
68		544.7
69		548.7
70		556.7

【0189】

【化118】

電荷輸送材料の化合物例

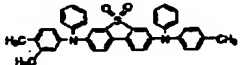
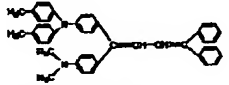
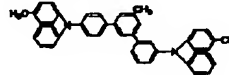
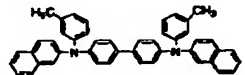
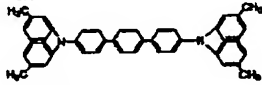
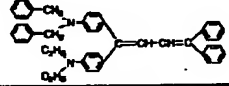
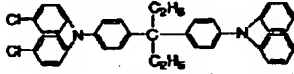
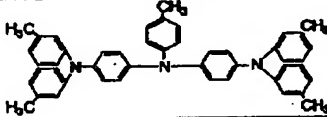
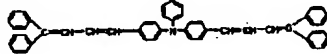
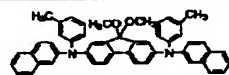
No.	化合物例	分子量
71		557.7
72		559.7
73		562.7
74		564.7
75		572.8
76		572.8
77		576.7
78		580.8
79		581.8
80		586.8

【0190】

【化119】



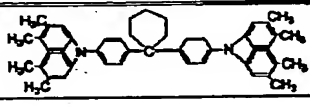
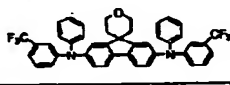
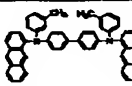
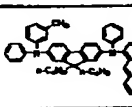
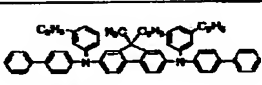
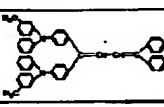
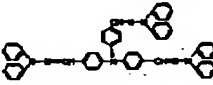
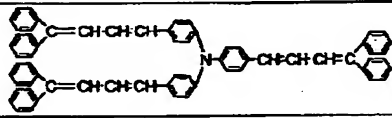
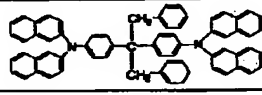
電荷輸送材料の化合物例

No.	化合物例	分子量
81		592.8
82		598.8
83		606.8
84		616.8
85		620.8
86		624.9
87		627.6
88		650.0
89		653.9
90		668.9

【0191】

【化120】

電荷輸送材料の化合物例

No.	化合物例	分子量
91		683.0
92		708.7
93		716.9
94		727.0
95		751.0
96		763.0
97		828.0
98		858.1
99		885.1

【0192】本発明において、分子量が350以上である電荷輸送材料以外の電荷輸送材料を更に添加することができる。但し、本発明の効果を十分に得るためには分子量が350以上である電荷輸送材料が感光層中の全電荷輸送材料の50質量%以上であることが好ましく、更に70質量%以上であることがより好ましい。

【0193】本発明の電子写真感光体の構成は、保護層下に感光層として電荷発生材料を含有する電荷発生層及び電荷輸送材料と結着樹脂を含有する電荷輸送層をこの順に積層した積層型、また電荷発生材料と電荷輸送材料と結着樹脂を同一層中に有する単層からなる単層型のいずれの構成をとることも可能である。

【0194】以下、積層型の感光層について説明する。

【0195】本発明における電荷輸送層は、電荷輸送材料を結着樹脂と共に溶剤に分散/溶解した溶液を塗布し、乾燥して形成することができる。

【0196】上記電荷輸送材料と共に用いる結着樹脂としては、従来用いられる電荷輸送層用の樹脂を用いるこ

とができ、例えば、ポリエステル、ポリカーボネート、ポリアリレート、ポリメタクリル酸エステル及びポリスチレン等が挙げられる。電荷輸送層の厚さは1～50μmであることが好ましく、特に5～30μmであることが好ましい。

【0197】この場合の電荷輸送材料と上記結着樹脂の比率は、両者の全質量を100とした場合に電荷輸送材料の質量が10～100が好ましく、好ましくは20～100の範囲で適宜選択される。

【0198】本発明における電荷発生層は、電荷発生材料を結着樹脂に分散した溶液を塗布し、乾燥することによって形成することが好ましいが、電荷発生材料のみを蒸着することによって形成してもよい。

【0199】電荷発生材料としては、セレンーテルル、ビリリウム、チアビリリウム系染料、また各種の中心金属及び結晶系、具体的には例えばα、β、γ、ε及びX型等の結晶型を有するフクロシアニン化合物、アントラントロン顔料、ジベンズピレンキノン顔料、ヒラントロ

ン顔料、トリシアゾ顔料、ジシアゾ顔料、モノシアゾ顔料、インジゴ顔料、キナクリドン顔料、非対称キノシアン顔料、キノシアン及び特開昭54-143645号公報に記載のアモルファスシリコン等が挙げられる。

【0200】電荷発生層は、前記電荷発生材料を0.3～4倍量の結着樹脂及び溶剤と共にホモジナイザー、超音波分散、ボールミル、振動ボールミル、サンドミル、アトライター及びロールミル等の方法で良く分散し、分散液を塗布し、乾燥されて形成されるか、又は前記電荷発生材料の蒸着膜等、単独組成の膜として形成される。その膜厚は5 $\mu$ m以下であることが好ましく、特に0.1～2 $\mu$ mの範囲であることが好ましい。

【0201】結着樹脂を用いる場合の例は、スチレン、酢酸ビニル、塩化ビニル、アクリル酸エステル、メタクリル酸エステル、フッ化ビニリデン、トリフルオロエチレン、等のビニル化合物の重合体及び共重合体、ポリビニルアルコール、ポリビニルアセタール、ポリカーボネート、ポリエステル、ポリスルホン、ポリフェニレンオキサイド、ポリウレタン、セルロース樹脂、フェノール樹脂、メラミン樹脂、ケイ素樹脂及びエポキシ樹脂等が挙げられる。

【0202】感光層が単層である場合は、上記電荷発生材料及び分子量350以上の電荷輸送材料を上記結着樹脂に分散及び溶解した溶液を塗布し、乾燥することによって形成することができる。

【0203】本発明における感光層には、各種添加剤を添加することができる。該添加剤とは、酸化防止剤及び紫外線吸収剤等の劣化防止剤や、フッ素原子含有樹脂微粒子等の潤剤その他である。

【0204】電子写真感光体の支持体としては導電性を有するものであればよく、例えばアルミニウム、銅、クロム、ニッケル、亜鉛及びステンレス等の金属や合金をドラム又はシート状に成形したもの、アルミニウム及び銅等の金属箔をプラスチックフィルムにラミネートしたもの、アルミニウム、酸化インジウム及び酸化錫等をプラスチックフィルムに蒸着したもの、導電性物質を単独又は結着樹脂と共に塗布して導電層を設けた金属、またプラスチックフィルム及び紙等が挙げられる。

【0205】本発明においては、導電性支持体表面を化成処理すなわち酸又はアルカリ水溶液との反応によって化学的に処理して不溶性の皮膜を形成してもよい。

【0206】導電性支持体の上には、バリアー機能と接着機能をもつ下引き層を設けることができる。下引き層は、感光層の接着性改良、塗工性改良、支持体の保護、支持体上の欠陥の被覆、支持体からの電荷注入性改良、また感光層の電氣的破壊に対する保護等のために形成される。

【0207】下引き層の材料としては、例えば、ポリエチレン樹脂、アクリル樹脂、メタクリル樹脂、ポリアミド樹脂、塩化ビニル樹脂、酢酸ビニル樹脂、フェノール

樹脂、ポリカーボネート樹脂、ポリウレタン樹脂、ポリイミド樹脂、塩化ビニリデン樹脂、ポリビニルアセタール樹脂、塩化ビニル酢酸ビニル共重合体、ポリビニルアルコール樹脂、水溶性ポリエステル樹脂、アルコール可溶性ナイロン樹脂、ニトロセルロース、カゼイン、ゼラチン、ポリグルタミン酸、澱粉、スターチアセテート、アミノ澱粉、ポリアクリル酸、ポリアクリルアミド等の樹脂、又はシランカップリング剤やジルコニウム、チタニウム、アルミニウム、マンガン等を含有する有機金属化合物等の金属有機化合物を、単独又は2種以上を混合して用いることができる。これらは、それぞれに適した溶剤に溶解されて支持体上に塗布される。その際の膜厚としては、0.1～5 $\mu$ mが好ましい。

【0208】これら各層の塗布方法としては、例えば、浸漬コーティング法、スプレーコーティング法、カーテンコーティング法及びスピンコーティング法等が知られているが、効率性/生産性の点からは浸漬コーティング法が好ましい。また、蒸着、プラズマその他の公知の製膜方法が適宜選択できる。

【0209】図1に本発明の電子写真感光体を有するプロセスカートリッジを用いた電子写真装置の概略構成を示す。

【0210】図において、1はドラム状の本発明の電子写真感光体であり、軸2を中心に矢印方向に所定の周速度で回転駆動される。電子写真感光体1は、回転過程において、一次帯電手段3によりその周面に正又は負の所定電位の均一帯電を受け、次いで、スリット露光やレーザービーム走査露光等の露光手段（不図示）から出力される目的の画像情報の時系列電気デジタル画像信号に対応して強調変調された露光光4を受ける。こうして電子写真感光体1の周面に対し、目的の画像情報に対応した静電潜像が順次形成されていく。

【0211】形成された静電潜像は、次いで現像手段5によりトナー現像され、不図示の給紙部から電子写真感光体1と転写手段6との間に電子写真感光体1の回転と同期して取り出されて給紙された転写材7に、電子写真感光体1の表面に形成担持されているトナー画像が転写手段6により順次転写されていく。

【0212】トナー画像の転写を受けた転写材7は、電子写真感光体面から分離されて像定着手段8へ導入されて像定着を受けることにより画像形成物（プリント、コピー）として装置外へプリントアウトされる。

【0213】像転写後の電子写真感光体1の表面は、クリーニング手段9によって転写残りトナーの除去を受けて清浄面化され、更に前露光手段（不図示）からの前露光光10により除電処理された後、繰り返し画像形成に使用される。なお、一次帯電手段3が帯電ローラー等を用いた接触帯電手段である場合は、前露光は必ずしも必要ではない。

【0214】本発明においては、上述の電子写真感光体

1、一次帯電手段3、現像手段5及びクリーニング手段9等の構成要素のうち、複数のものを容器11に納めてプロセスカートリッジとして一体に結合して構成し、このプロセスカートリッジを複写機やレーザービームプリンター等の電子写真装置本体に対して着脱自在に構成してもよい。例えば、一次帯電手段3、現像手段5及びクリーニング手段9の少なくとも一つを電子写真感光体1と共に一体に支持してカートリッジ化して、装置本体のレール等の案内手段12を用いて装置本体に着脱自在なプロセスカートリッジとすることができる。

【0215】また、露光光4は、電子写真装置が複写機やプリンターである場合には、原稿からの反射光や透過光、あるいは、センサーで原稿を読み取り、信号化し、この信号に従って行われるレーザービームの走査、LEDアレイの駆動及び液晶シャッターアレイの駆動等により照射される光である。

【0216】本発明の電子写真感光体は、電子写真複写機に利用するのみならず、レーザービームプリンター、CRTプリンター、LEDプリンター、FAX、液晶プリンター及びレーザー製版等の電子写真応用分野にも広く用いることができる。

【0217】

【実施例】以下、実施例に従って本発明を更に詳細に説明する。なお、実施例中の「部」は質量部を表す。

【0218】(実施例1) まず導電層用の塗料を以下の手順で調製した。10質量%の酸化アンチモンを含有する酸化スズで被覆した導電性酸化チタン粉体50部、フェノール樹脂25部、メチルセロソルブ20部、メタノ

ール5部及びシリコンオイル(ポリジメチルシロキサンポリオキシアルキレン共重合体、平均分子量3000)0.002部をφ1mmガラスビーズを用いたサンドミル装置で2時間分散して調製した。この塗料をφ30mmのアルミニウムシリンダー上に浸漬塗布方法で塗布し、140℃で30分間乾燥することによって、膜厚が20μmの導電層を形成した。

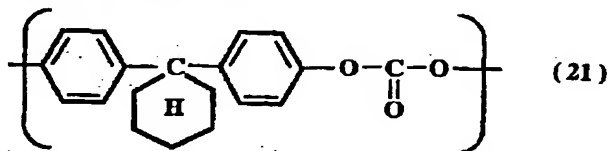
【0219】次に、N-メトキシメチル化ナイロン5部をメタノール95部中に溶解し、中間層用塗料を調製した。この塗料を前記の導電層上に浸漬コーティング法によって塗布し、100℃で20分間乾燥することによって、膜厚が0.6μmの中間層を形成した。

【0220】次に、CuKαの特性X線回折におけるブラッグ角(2θ±0.2度)が9.0度、14.2度、23.9度及び27.1度に強いピークを有するオキシチタニウムフタロシアニン3部、ポリビニルブチラール(商品名:エスレックBM2、積水化学(株)製)3部及びシクロヘキサノン35部をφ1mmガラスビーズを用いたサンドミル装置で2時間分散して、その後酢酸エチル60部を加えて電荷発生層用塗料を調製した。この塗料を前記の中間層の上に浸漬塗布方法で塗布し、50℃で10分間乾燥することによって、膜厚が0.2μmの電荷発生層を形成した。

【0221】次いで、電荷輸送材料として化合物例No. 54を10部及び下記構造式(21)の繰り返し単位を有するポリカーボネート樹脂10部を

【0222】

【化121】



(M<sub>n</sub>≒20000)

モノクロロベンゼン50部/ジクロロメタン30部の混合溶媒中に溶解し、電荷輸送層用塗布液を調製した。この塗布液を前記の電荷発生層上に浸漬コーティングし、110℃で1時間乾燥することによって、膜厚が20μmの電荷輸送層を形成した。

【0223】次いで、化合物例No. 6の正孔輸送性化合物60部をモノクロロベンゼン50部/ジクロロメタン50部の混合溶媒中に溶解し保護層用塗料を調製した。この塗料をスプレーコーティング法により、先の電荷輸送層上に塗布し、加速電圧150KV、線量30Mradの条件で電子線を照射し樹脂を硬化することによって、膜厚が5μmの保護層を形成し、電子写真感光体を得た。

【0224】作製した電子写真感光体をキヤノン(株)製LBP-SXに装着して初期電子写真特性を評価し

た。初期の感光体特性[光減衰感度(暗部電位-700V設定で-200Vに光減衰させるために必要な光量)及び残留電位V<sub>s1</sub>(光減衰感度の光量の3倍の光量を照射したときの電位)]を常温常湿環境下(23℃/50%RH)の環境で測定して求めた。その後、環境を高温高湿下(32℃/85%RH)(H/H)に変え、V<sub>1</sub>の常温常湿環境下からの変動量(ΔV<sub>1</sub>)を測定した。結果を表3に示す。

【0225】(実施例2〜22及び比較例1〜4)実施例1の保護層中の正孔輸送性化合物、あるいは感光層中の電荷輸送材料を表3の様に代えた以外は、実施例1と同様にして電子写真感光体を作製し、評価した。その結果を表3に示す。

【0226】(実施例23)実施例1の電荷輸送材料の化合物例No. 54 10部を化合物例No. 198部

及び化合物例No. 54 2部に代えた以外は、実施例1と同様にして電子写真感光体を作製し、評価した。結果を表4に示す。

【0227】(実施例24) 実施例1の電荷輸送材料の化合物例No. 54 10部を化合物例No. 53部及び化合物例No. 54 7部に代えた以外は、実施例1と同様にして電子写真感光体を作製し、評価した。結果を表4に示す。

【0228】(実施例25) 実施例1の電荷輸送材料の化合物例No. 54 10部を化合物例No. 57部及び化合物例No. 54 3部に代えた以外は、実施例1と同様にして電子写真感光体を作製し、評価した。結果を表4に示す。

【0229】(実施例26) まず、電子写真用感光体支持体を以下の手順で得た。φ30mmアルミニウムシリンドラを用意し、有機りん酸としてフィチン酸及び金属としてチタニウムを含有するノンクロメート化成処理剤液(商品名: パルコート3753、日本パーカライジグ株式会社製)を40℃の温度に保ち、この液中に上記のアルミニウムシリンドラを浸漬し、1分間化成処理を行った後、純水で洗浄し、自然乾燥させて支持体とした。

【0230】上記支持体上に実施例1と同様にして電荷発生層、電荷輸送層、保護層を形成し、評価した。結果を表4に示す。

【0231】(実施例27及び28) 実施例26の電荷輸送材料の化合物例No. 54を化合物例No. 29及び化合物例No. 68に代えた以外は、実施例26と同様にして電子写真感光体を作製し、評価した。結果を表4に示す。

【0232】(実施例29) φ30mmアルミニウムシリンドラをホーニング処理し、超音波水洗浄したものを導電性支持体とした。

【0233】次に、メトキシエタノール160部にジルコニウムテトラ-*n*-ブトキシサイドの85%ブタノール溶液(関東化学社製)64部(0.06mol)及びチタニウムテトラ-*n*-ブトキシサイド(キシダ化学社製)22部(0.14mol)を滴下し、メトキシエタノール/純水=160部/11部の混合溶液を更に加える。更に、アセチルアセトン20部をメタノール200部に加えた溶液を滴下した後、ヒドロキシプロピルセルロー

ス(東京化成工業社製)の10質量%メタノール液55部を混合して得た中間層塗布液をアルミニウムシリンドラ一支持体上に浸漬塗布し、120℃で15分間加熱乾燥させることによって、膜厚が0.3μmの中間層を形成した。

【0234】上記中間層上に実施例1と同様にして電荷発生層、電荷輸送層、保護層を形成し、評価した。結果を表4に示す。

【0235】(実施例30及び31) 実施例29の電荷輸送材料の化合物例No. 54を化合物例No. 32及び化合物例No. 40に代えた以外は、実施例29と同様にして電子写真感光体を作製し、評価した。結果を表4に示す。

【0236】(実施例32) 電荷輸送層用塗布液を以下のように調製した以外は、実施例2と同様にして電子写真感光体を作製し、評価した。結果を表4に示す。

【0237】電荷輸送材料の化合物例No. 54 16部、前記構造式(21)の繰返し単位を有するポリカーボネート樹脂4部及び酸化防止剤(商品名: イルガノックス1330、チバガイギー社製)1部をモノクロロベンゼン50部/ジクロロメタン30部の混合溶媒中に溶解し、電荷輸送層用塗布液を調製した。

【0238】(実施例33) 電荷輸送層用塗布液を以下のように調製した以外は、実施例1と同様にして電子写真感光体を作製し、評価した。結果を表4に示す。

【0239】電荷輸送材料の化合物例No. 98 3部と化合物例No. 89 1部、前記構造式(21)の繰返し単位を有するポリカーボネート樹脂16部、酸化防止剤(商品名: Sumilizer GS、住友化学(株)製)0.5部及び酸化防止剤(商品名: IRGAFOS-168、日本チバガイギー社製)0.5部をモノクロロベンゼン50部/ジクロロメタン30部の混合溶媒中に溶解し、電荷輸送層用塗布液を調製した。

【0240】表3及び表4の実施例に示すように、分子量350以上の電荷輸送材料を用いると電位特性及び環境特性が良好であるのに対し、比較例に示すように分子量350未満の電荷輸送材料を用いると感度低下、残留電位の上昇を生じたものもあったり、また環境変動の大きなものもあった。

【0241】

【表3】

表 3

	正孔輸送性化合物 No.	電荷輸送材料 No.	電位特性		環境変動 $\Delta V_1$ (-V)
			感度 ( $\mu\text{J}/\text{cm}^2$ )	$V_{sl}$ (-V)	
実施例	6	54	0.20	30	14
1	10	54	0.20	32	15
2	25	54	0.23	35	13
3	29	54	0.21	30	14
4	242	54	0.22	33	20
5	246	54	0.18	31	13
6	249	54	0.22	36	12
7	260	54	0.24	40	23
8	263	54	0.19	32	15
9	266	54	0.20	30	16
10	267	54	0.21	31	15
11	838	54	0.24	43	22
12	415	54	0.25	46	26
13	429	54	0.25	43	26
14	6	19	0.20	50	18
15	6	33	0.24	45	13
16	6	45	0.24	38	15
17	6	56	0.22	34	15
18	6	70	0.22	30	17
19	6	85	0.21	32	25
20	6	92	0.19	30	23
21	6	96	0.20	33	17
比較例	6	2	—	230	64
1	6	4	—	205	54
2	6	7	0.34	136	35
3	6	8	0.31	115	37

【0242】

【表4】

表 4

	電位特性		環境変動 $\Delta V_1$ (-V)
	感度 ( $\mu\text{J}/\text{cm}^2$ )	$V_{sl}$ (-V)	
実施例	0.19	29	15
23	0.23	38	20
24	0.27	52	37
25	0.21	37	17
26	0.23	43	20
27	0.20	33	17
28	0.20	31	14
29	0.22	40	20
30	0.20	30	15
31	0.18	28	14
32	0.28	45	25

【0243】

【発明の効果】本発明によれば、感度が良好であり、残留電位の上昇が少なく、環境による電位変動が小さい等の電子写真特性が非常に良好であり常に安定した性能を発揮することができる電子写真感光体を提供することができた。

【0244】また、上記電子写真感光体の効果は、その

電子写真感光体を有するプロセスカートリッジ及び電子写真装置においても当然に発揮され、長期間高画質が維持される。

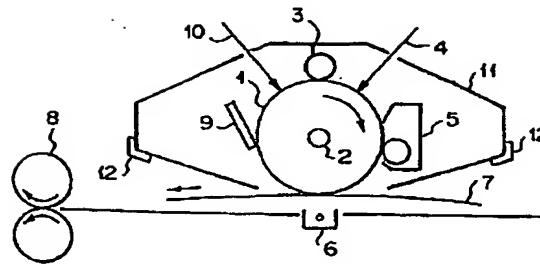
【図面の簡単な説明】

【図1】本発明の電子写真感光体を有するプロセスカートリッジを用いる電子写真装置の概略構成の例を示す図である。

【符号の説明】

- 1 電子写真感光体
- 2 軸
- 3 帯電手段
- 4 露光光
- 5 現像手段
- 6 転写手段
- 7 転写材
- 8 定着手段
- 9 クリーニング手段
- 10 前露光光
- 11 プロセスカートリッジ容器
- 12 案内手段

【図1】



フロントページの続き

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